6 MAY 1954 NINEPENCE

ELECTRICAL TIMES

Here is the motor starter for today, tomorrow and years ahead—a design that is new in every detail, from the leading motor control gear specialists in Britain. Built for heavy duty and for vital machine tool applications, it will last as long as the equipment it protects.

OUTSTANDING FEATURES INCLUDE

- Unit construction to meet a wide range of purposes from one set of standard parts.
- Precision overload relays with heaters designed specifically for individual motor ratings.
- One starter for both auto and manual resetting.
- Easiest of all starters to install and maintain.

Ratings 1½—15 H.P.

Send for 'Autoline' Brochure Ref. No. 547

THE FINEST
PROTECTION A MOTOR CAN HAVE
THE NEW MEM
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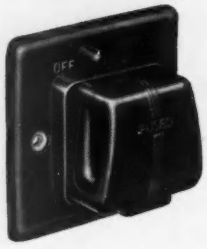
MIDLAND ELECTRIC MANUFACTURING CO., LTD.,
TYSELEY, BIRMINGHAM, 11. *Branches at London and Manchester*

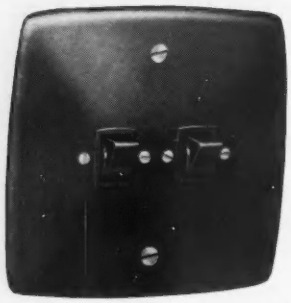
There's a Miniac for every switching operation

and they all save you TIME! LABOUR! MONEY!

Neat and attractive, this ceiling switch is easy to install and competitive in price

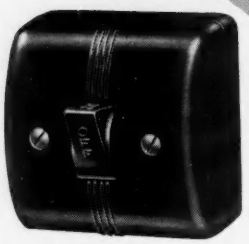


13-amp flush pattern Shuttered Switch Socket with D.P. Switch; ingenious construction; dolly in best position to avoid damage

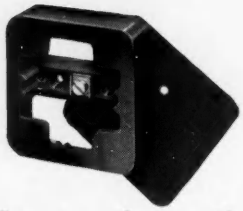


Assemblies for BS1299 & Plaster Depth installations—1 or 2 gang in one box, steel, wood or moulded

IMPORTANT
With the Miniac range all necessary holes are tapped, all screws are captive—and there are hosts of other reasons why you should specify and sell Miniac



15 and 30-amp D.P. switches for controlling immersion heaters etc. Can also be arranged with auxiliary terminals for apparatus such as pilot lights (see mounting pattress below)



This pattress for use with 15-amp D.P. switch incorporates an earth terminal so that quick and neat connection can be made. Knockouts permit both back and side entry

MINIAC—the largest range of A.C. switches and switch sockets

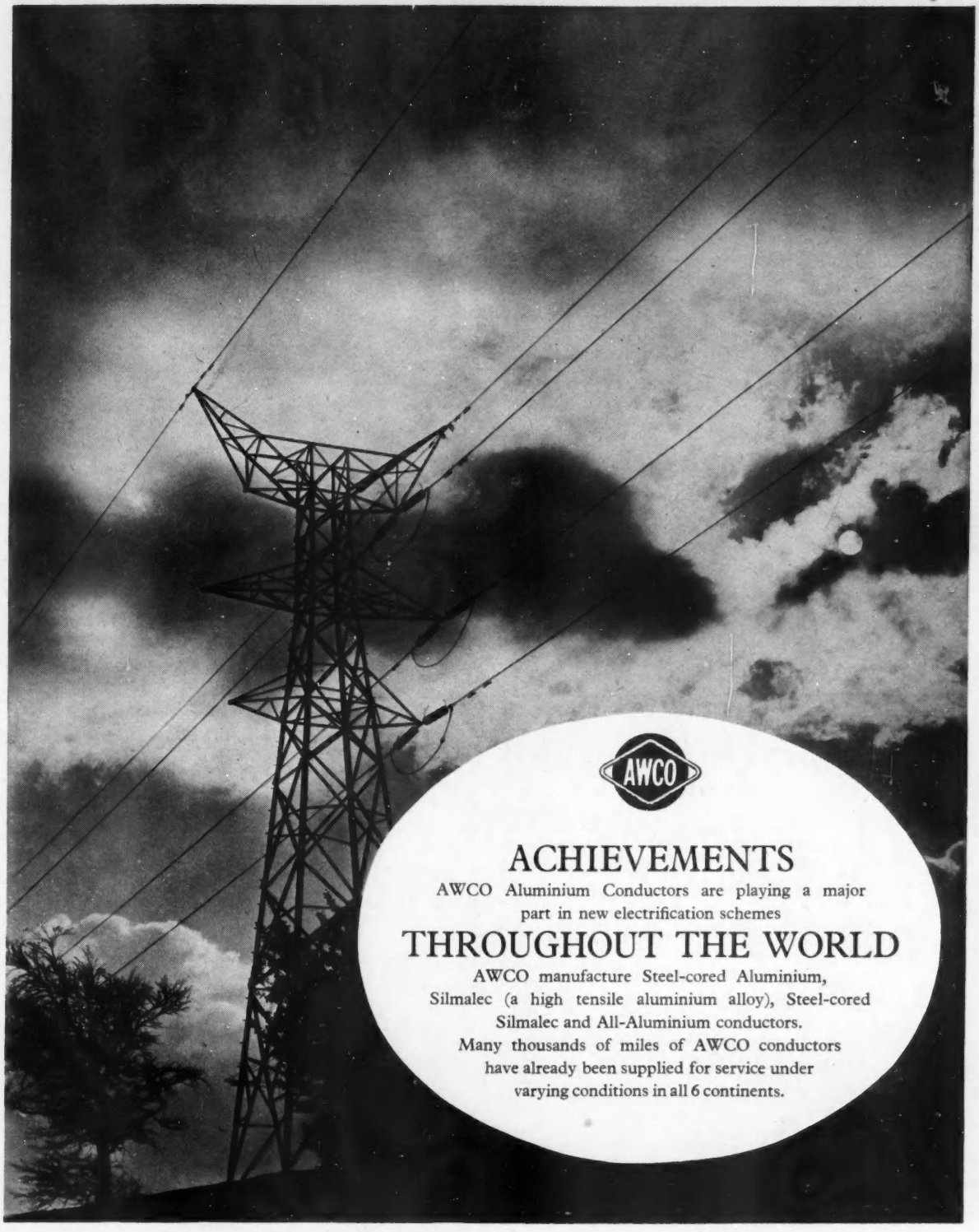
—designed in accordance with B.S.S. and I.E.E. requirements, of course!

Flush	Ceiling	Assemblies for B.S.1299 Box
Surface	Push on—Push off	5-amp to 30-amp Switches
Plaster Depth	Bell Push	5, 13 and 15-amp Switch Sockets

Lundberg accessories made by the House of **Simplex**

SIMPLEX ELECTRIC COMPANY LIMITED BROADWELL OLDBURY BIRMINGHAM & BRANCHES

A TI COMPANY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AWCO manufacture Steel-cored Aluminium, Silmalec (a high tensile aluminium alloy), Steel-cored Silmalec and All-Aluminium conductors.
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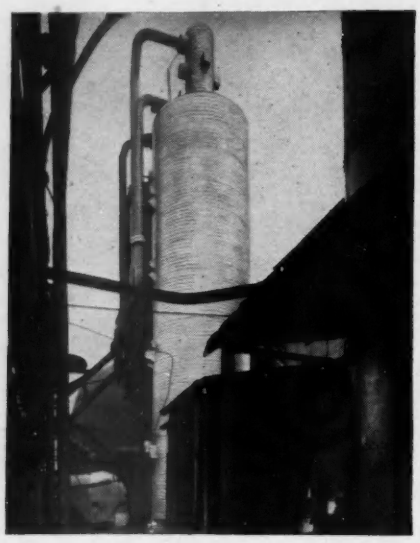

The photograph shows the insulation and protection of a 40 ft. high liquid CO_2 storage vessel at a large Essex chemical works. The vessel is insulated with Onazote, which is externally finished with a bitumen compound, and finally wrapped with Aluminium painted DENSELT TAPE.

DENSO PRODUCTS

The photograph, taken at a large chemical works in London, shows the insulation and protection of exposed pipes. These are insulated with Onazote, wrapped with adhesive tape, followed by plastic bitumen dressing and finished off with Aluminium painted DENSELT TAPE, spirally wrapped over the plastic bitumen dressing.

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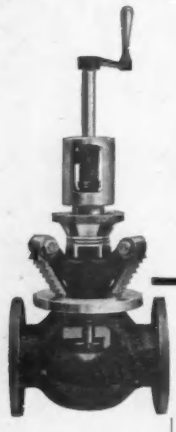
and cut out steam losses



This tool not only saves steam—and therefore fuel—but saves time and dislocation of work as the valve can be reseated WITHOUT BREAKING THE PIPELINE. It takes only one man to operate it and it gives a true face free from knurling in a few minutes. It is self-centring in the valve chest and the cutter is visible during the reseating operation. Moderate in price—write for full descriptive literature.

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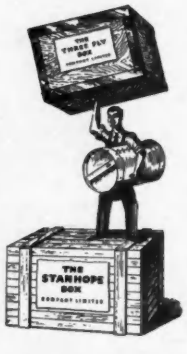
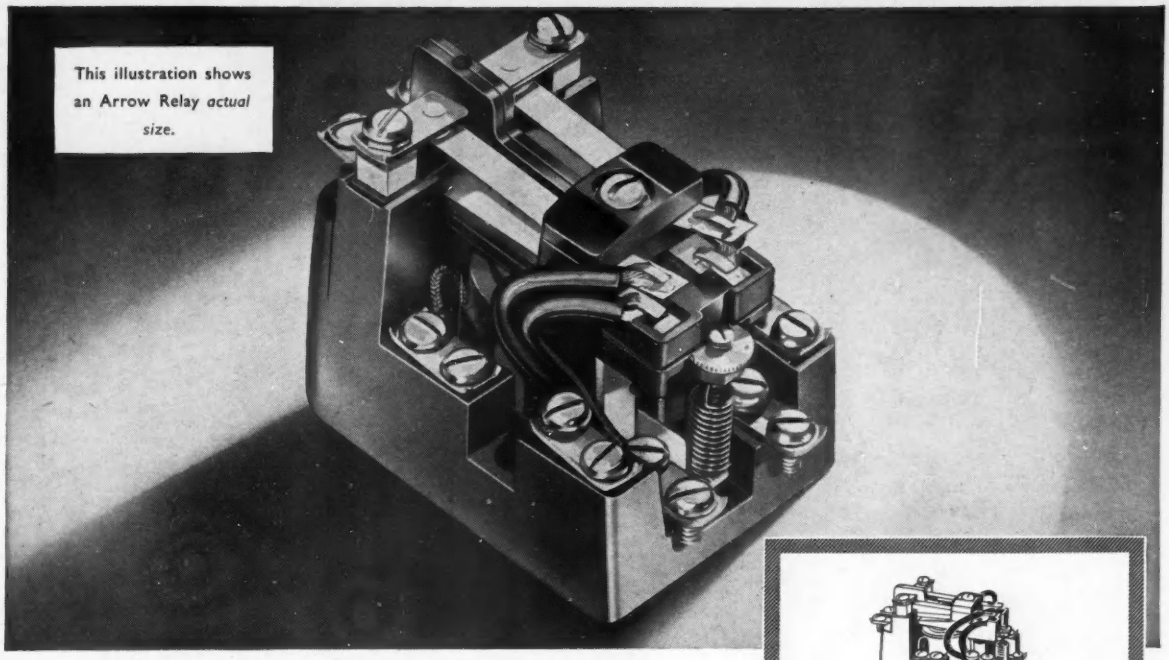


RELAYS for LONG AND SILENT SERVICE



This illustration shows an Arrow Relay *actual size.*

Made by skilled craftsmen from first-quality materials, Arrow Relays, like all Arrow products, are individually produced; they are designed and built to ensure exceptionally long and silent service.

Essentially compact, no less than thirty different circuit arrangements are available on the standard base. Silver-to-silver butt type contacts give continuous rating up to 10 amps per pole at 230 volts AC. Operating coils, of low wattage consumption and continuously rated, are available for 6 to 550 volts AC and 6 to 230 volts DC.

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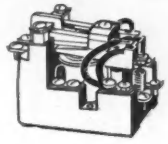
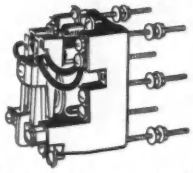
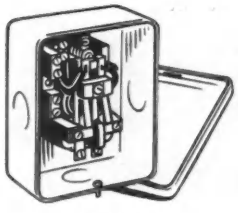


1. For surface mounting



2. For back of panel wiring



3. Enclosed

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Conymel M	**"**	**"**	**"**	**"**	**"**
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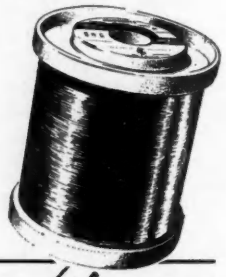
We shall be pleased to mail you one or more sets, if you will kindly write us on your business letterheading.



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The largest manufacturers of fine enamelled wires in the world

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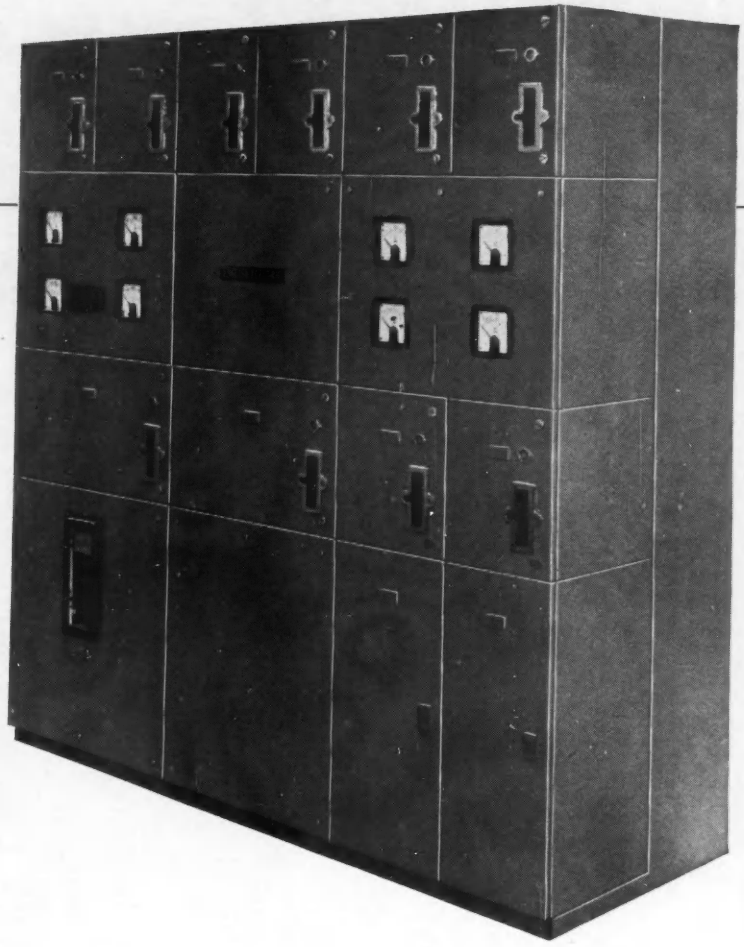
'Superform' fuse switchboards



This 'Superform' Fuse Switchboard gained the Silver Plaque at the 1954 Electrical Engineers Exhibition, Earls Court, for the most outstanding industrial development.

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A staff of Fusegear technical engineers will be in attendance.

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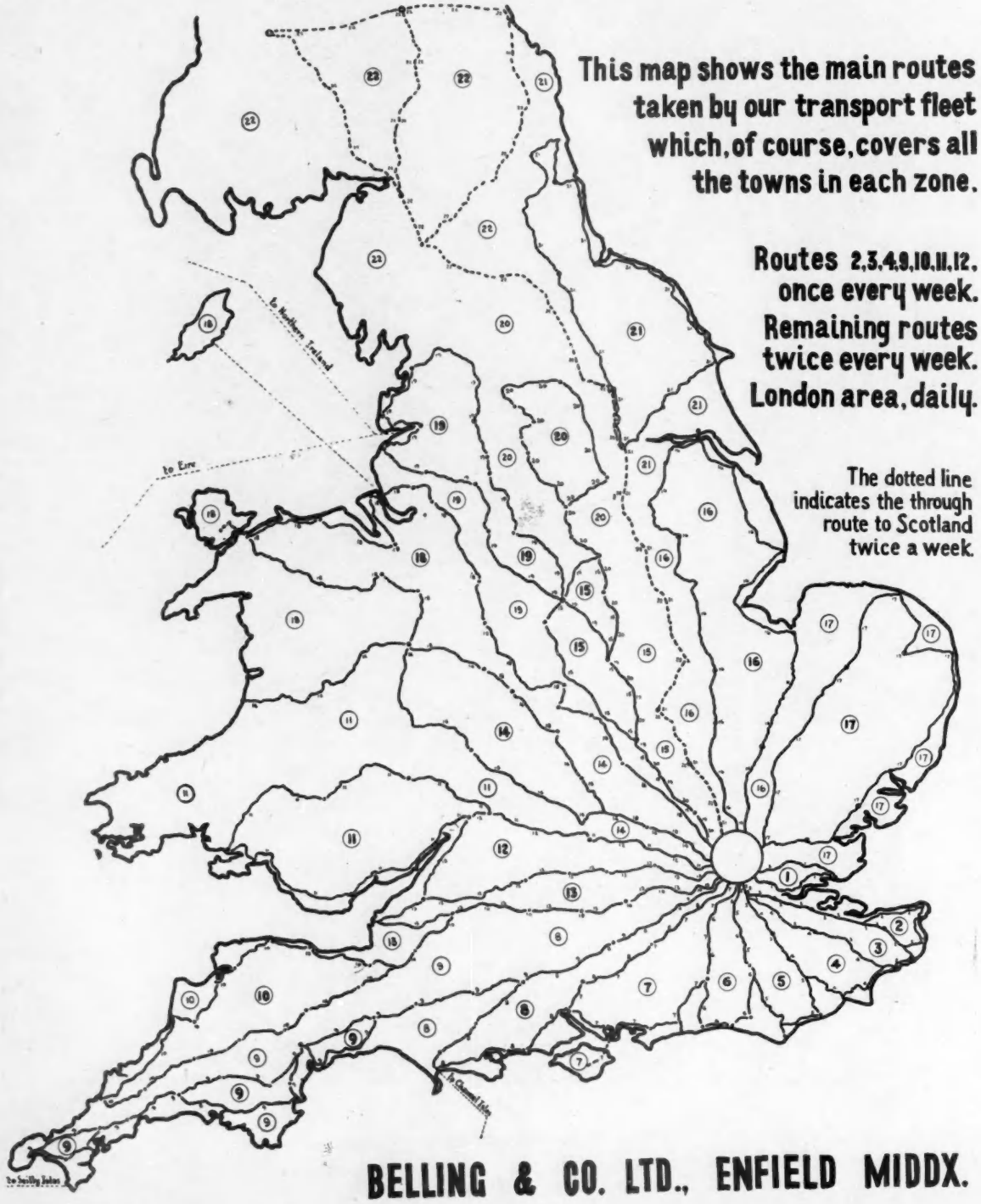

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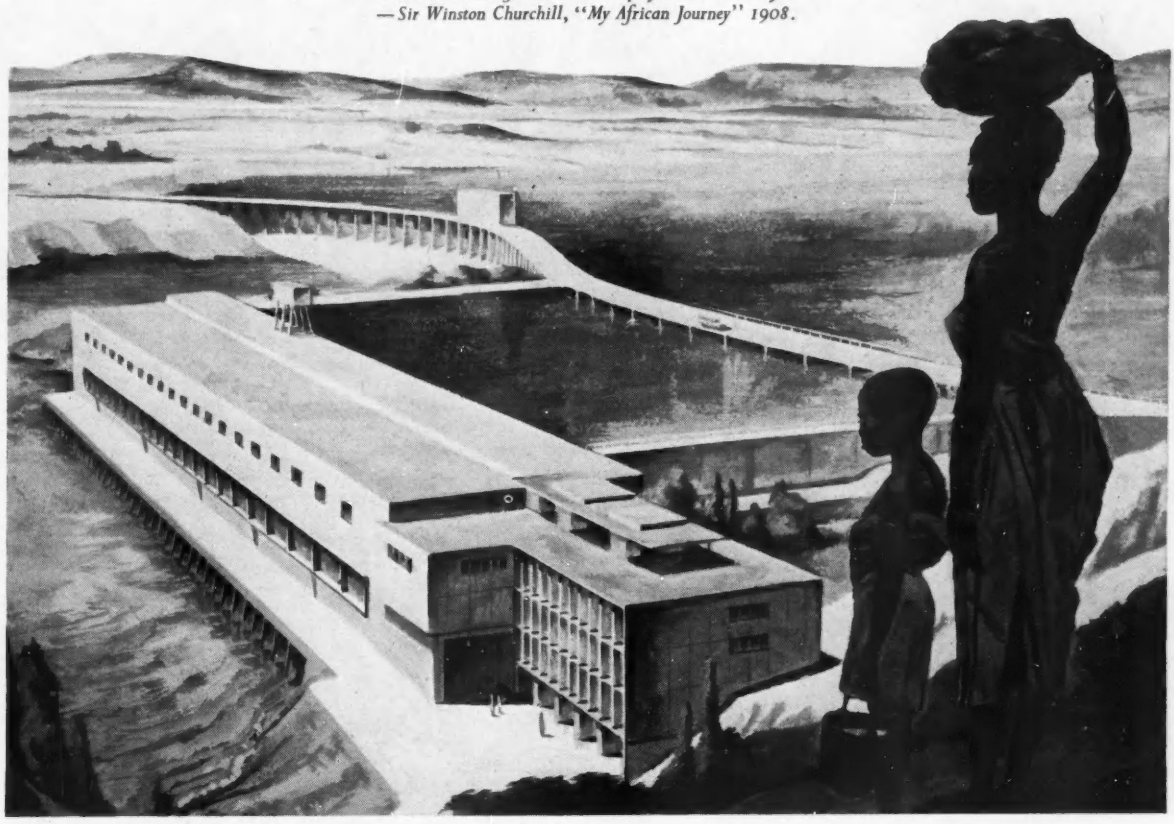

In 1908 Sir Winston Churchill dreamed of harnessing the headwaters of the Nile to generate electricity. In 1954 Her Majesty Queen Elizabeth II inaugurates the Owen Falls hydro-electric scheme and brings to life a majestic project that will provide electricity for the future development of Uganda and parts of Kenya. Started in 1948 by the Uganda Electricity Board, the Owen Falls plan includes a main dam 2,725 feet long and 85 feet high; also a powerhouse to be equipped with ten 15,000 k.w generating units — Boving "Kaplan" hydro-turbines and British Thomson-Houston Ltd. "umbrella" type alternators.

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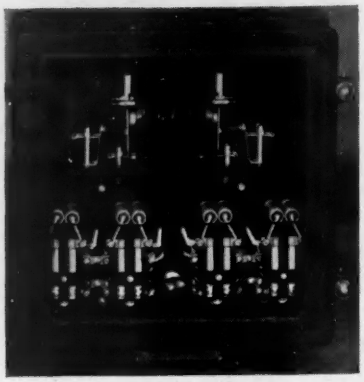

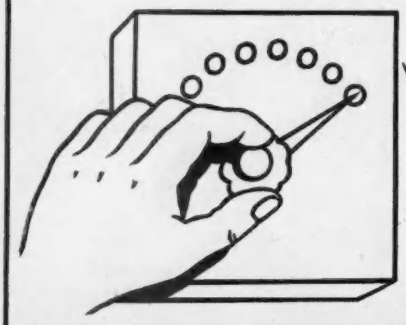

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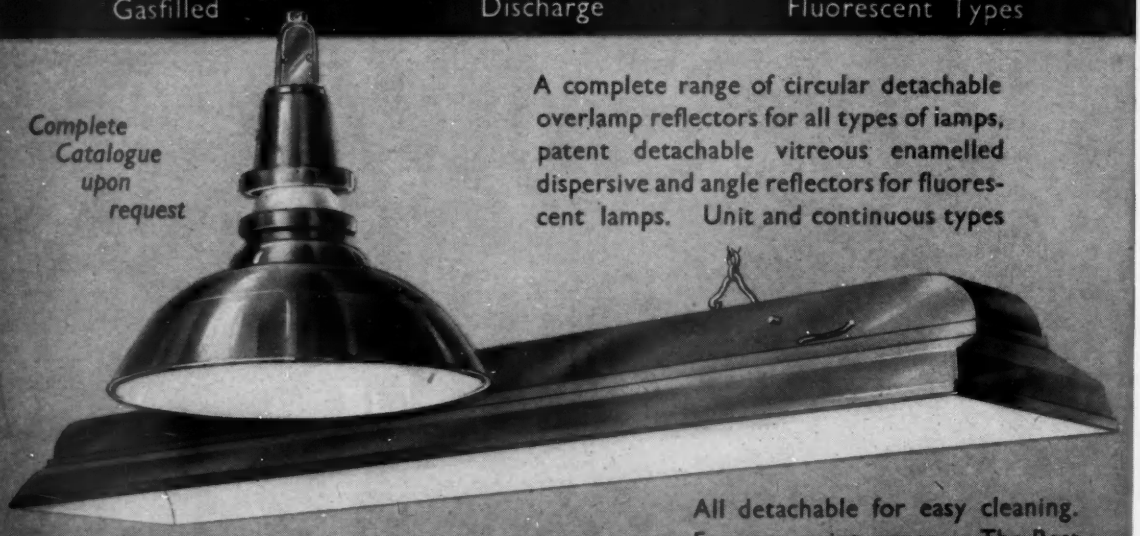

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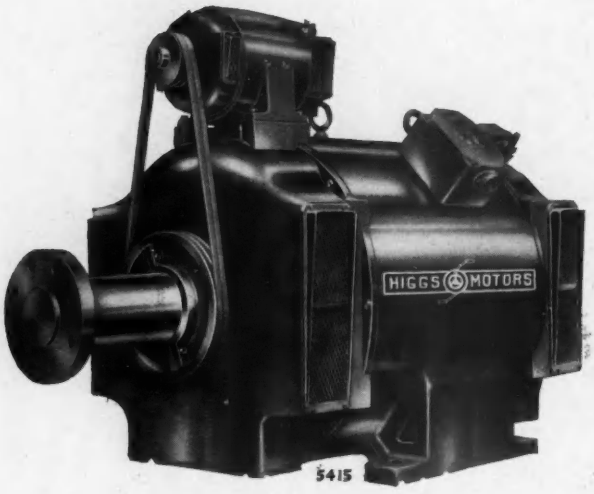

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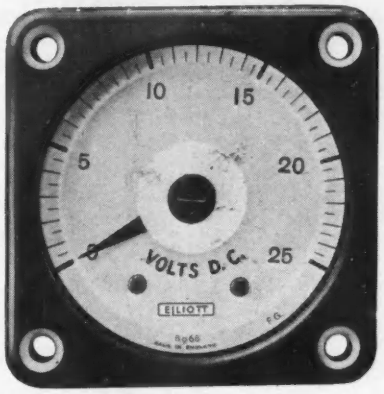

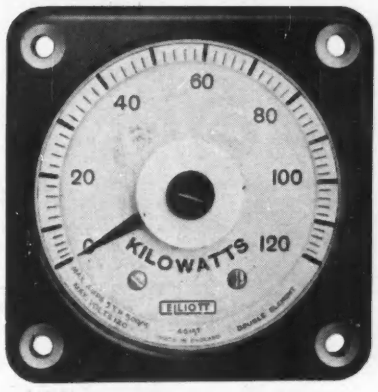

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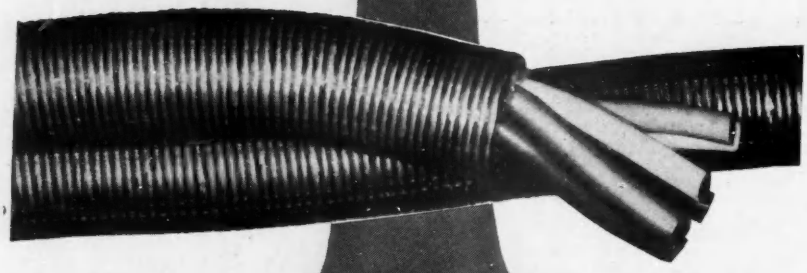

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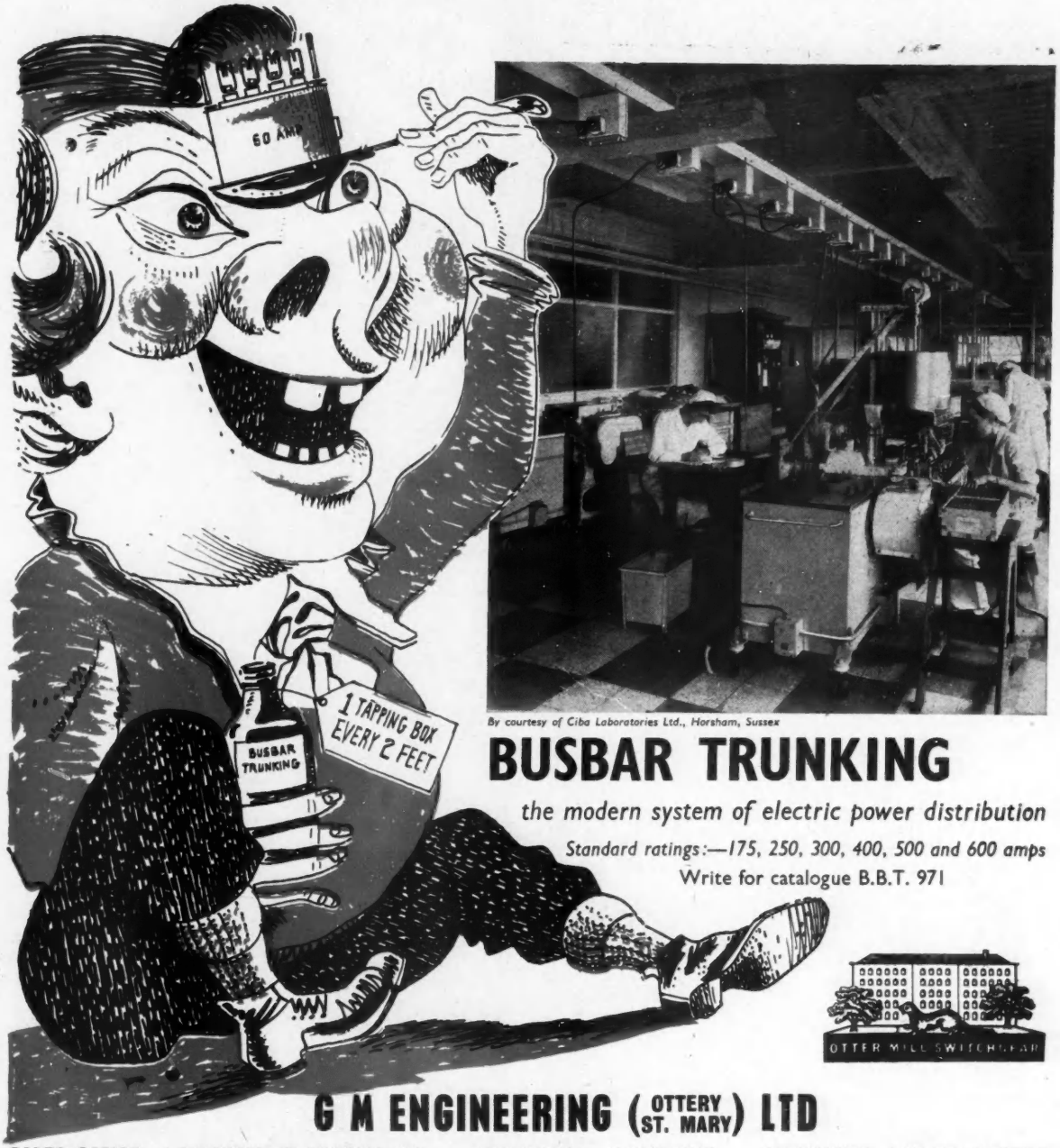

By courtesy of Ciba Laboratories Ltd., Horsham, Sussex

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the modern system of electric power distribution

Standard ratings:—175, 250, 300, 400, 500 and 600 amps

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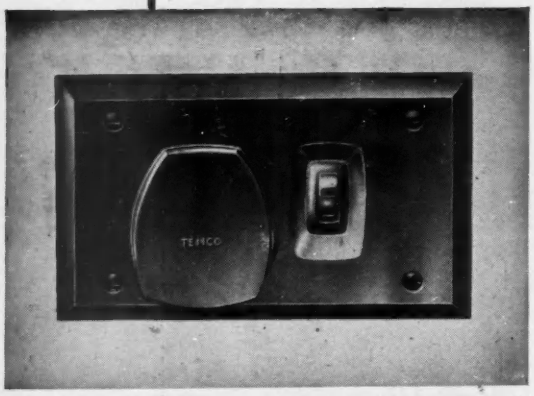

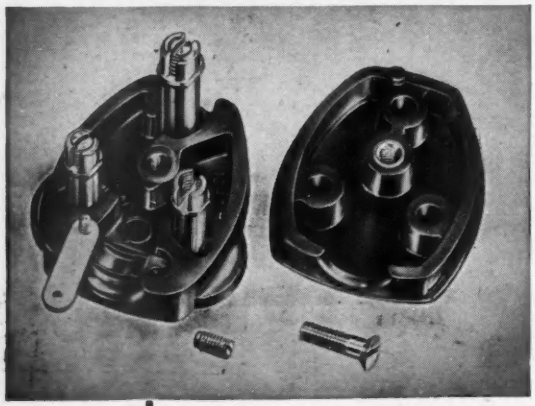

- ★ 5 and 15 amp. 3-pin to B.S.546
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- ★ Single and Double Pole
- ★ Brown and Cream
- ★ Neat, attractive, individually packed
- ★ Designed for easy wiring
- ★ High quality at low price

If you have not received details of these new TEMCO Switch Sockets and Plugs, please write for the full descriptive leaflet.

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5 *now in commission*

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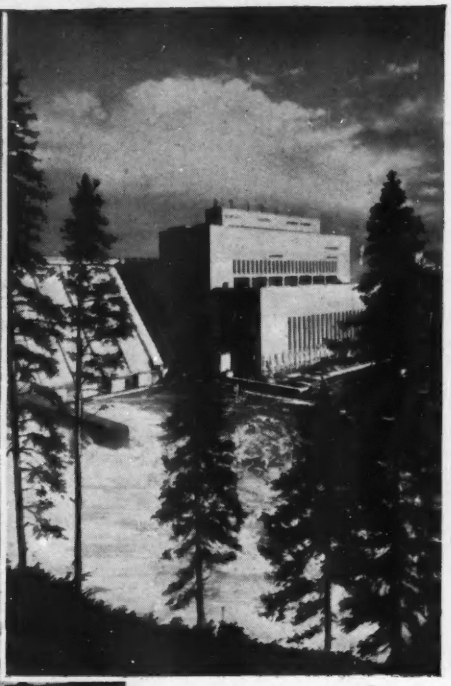

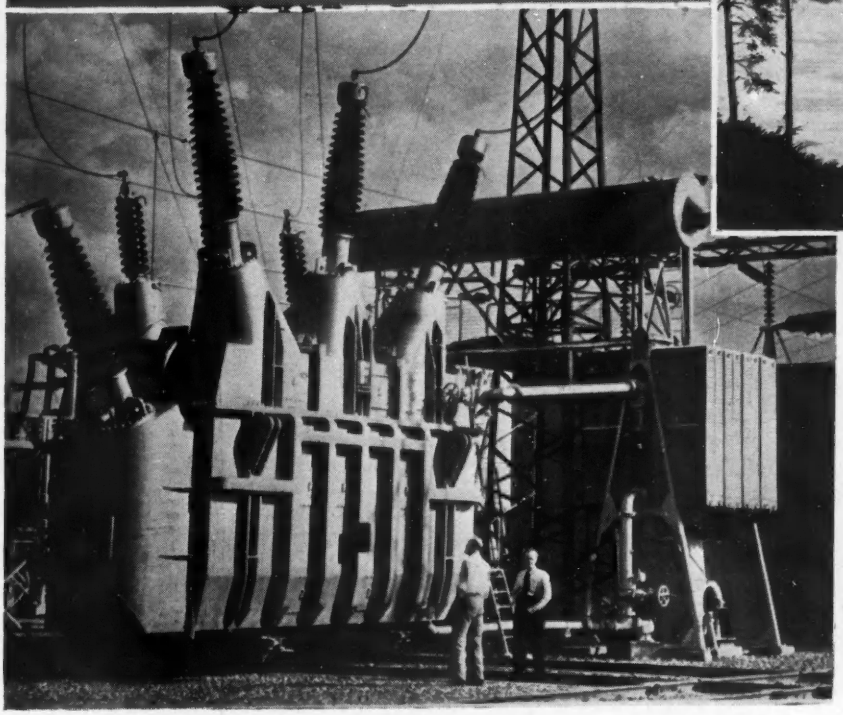

(Above). The Pyhäkoski Power Station, total output 108 MW, the largest in the current water power programme of Finland.
(Left). One of the completed transformers in commission at the Pyhäkoski Generating Station.

Five of the six 230,000 Volt three-phase transformers for the Imatra Power Company, Finland, are now in commission at the Pyhäkoski Generating Station and Hikia Transforming Station. These were the first 230,000 Volt three-phase transformers to be ordered in Great Britain, each transformer being rated at 64/64/32 MVA, 231/115.5/10.5 kV, and having a total weight with cooling gear of 220 tons.

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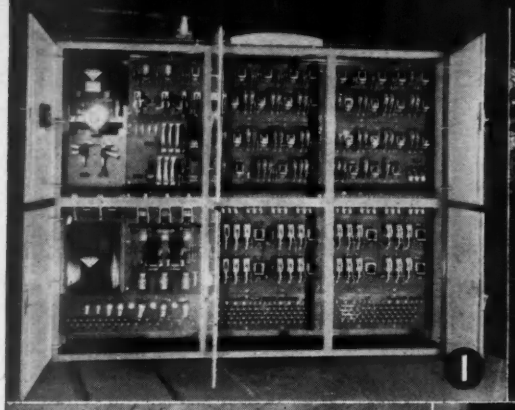
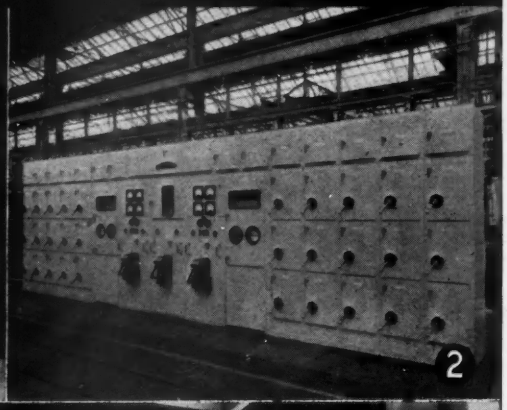
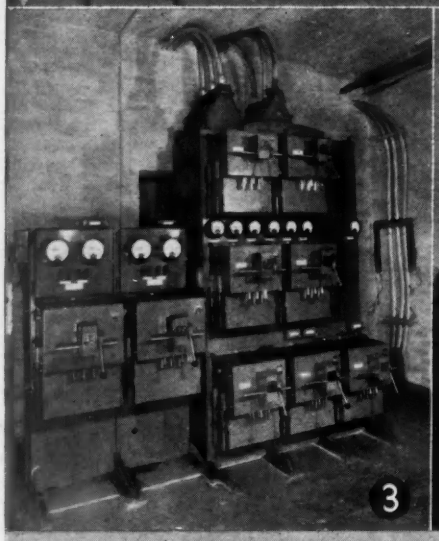
FT139

SWITCHGEAR







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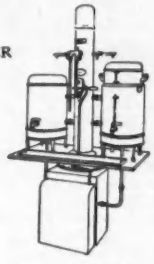
'JACKSON' BOILER



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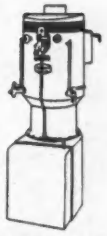
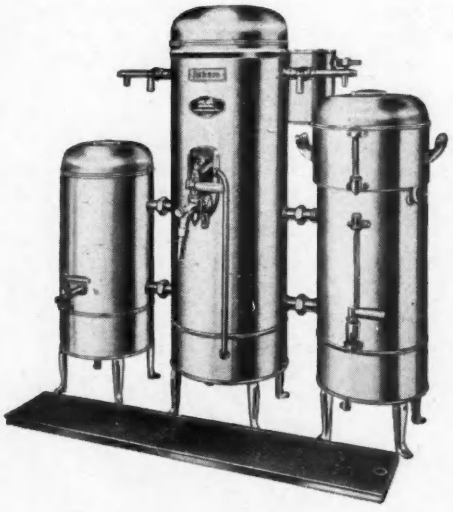
You expect a lot from your boiler :
a service of unfailing regularity—
whatever the pressure of work ;
however long the working hours.

And that is just how the
' Jackson ' Boiler has built its reputation :
on the thing that matters most—
a regular and unfailing supply of
fresh and positively boiling water.



'TEATOMATON' FOR FACTORY CATERING

TWO FLASK GLASS COFFEE MAKER



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Jackson Boilers

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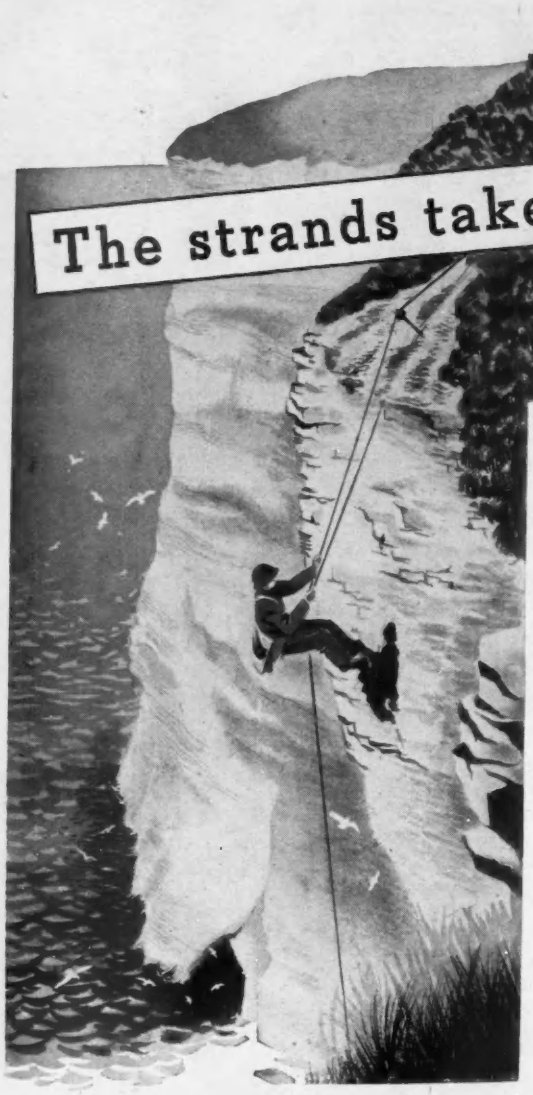

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Running endlessly through the Turners Cord V Belt is a line of high-tensile strands which gives the belt its great resilience and its ability to stand up to sudden shock loads without deterioration.

Other features which contribute to smooth, efficient transmission are: specially compounded rubber cushions above and below the line of cords and a bias-cut outer covering of cotton duck for a wear-resisting, non-slip surface.

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CORD V BELTS

Made to B.S.S. 1440/1948

Makers also of
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V30

It's Moisture-Proof!

New METROVICK Fluorescent Lighting Fitting

This METROVICK moisture-proof fitting is specially made for use in laundries, textile mills, garages, paper-making plants and other places where water spray, steam or excessive humidity is encountered. The fitting is suitable for indoor or outdoor use. A two-lamp fitting is also available.

SPECIFICATION

Two water-tight auxiliary gearboxes cast in aluminium alloy house the 'instant-start' unit and the capacitor. Opal Perspex reflector. Watertight rubber lampholders.

Radio interference suppressor fitted. Fittings supplied complete with gear ready wired for connection to supply mains. Suitable for chain or conduit suspension.

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Moisture-proof Fluorescent Lighting Fittings

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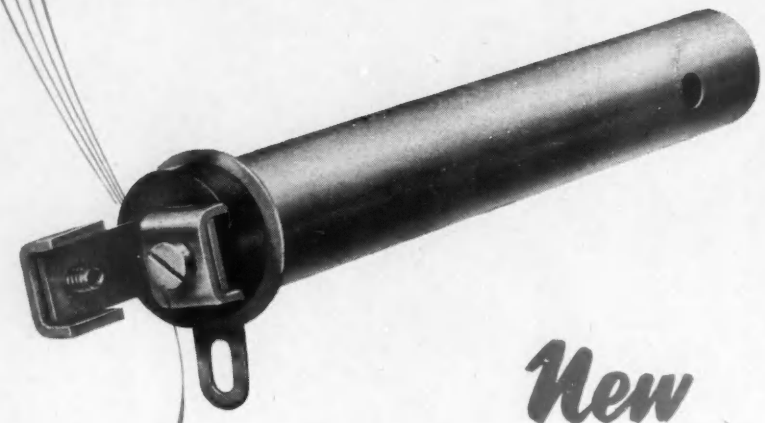
Member of the AEI group of companies

5/F405

PROGRESS IN CONTROL



New

WATER HEATER THERMOSTAT

at half the price!

For many years the name Sunvic has meant dependable thermostatic control of electric water heaters. Now a new model, type TQB, whilst maintaining the same standard, is at the same time more compact and costs half the price. It is an immersed, withdrawable type and its performance complies with BS.1555.

The only available thermostat conforming to present trends, its introduction marks an important advance in thermostat design.

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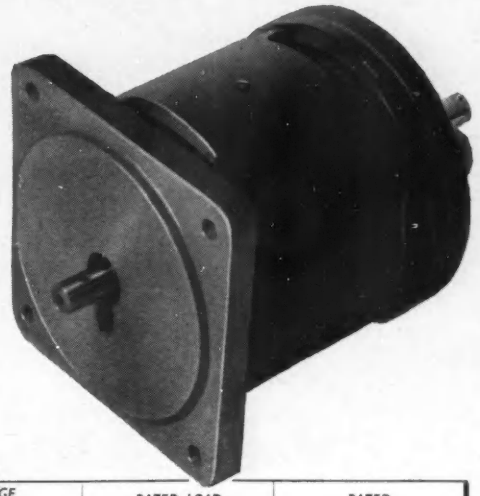
offer prompt delivery of

SPECIAL PURPOSE A.C. MOTORS

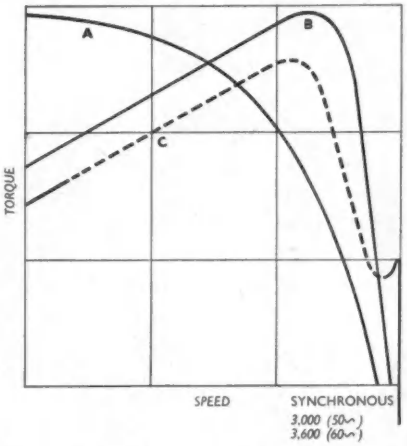
THREE PHASE, TWO PHASE OR SINGLE PHASE (CAPACITOR START AND RUN)



● *Motors may be wound for a range of supply frequencies and voltages.*

FRAME SIZE	SUPPLY PHASES	CHARACTERISTIC	AVERAGE STARTING TORQUE	RATED LOAD TORQUE	RATED H.P.
FC33 & 34	1 or 2	C	1.2	.85	1/400
FC31 & 32	1 or 2	A	2.6	1.7	1/300
FC35 & 36	1 or 2	B	1.5	2.0	1/200
FC30	3	A	4.6	2.6	1/200
FZ2 & 3	1 or 2	A	4.6	3.4	1/150
FZ11 & 12	1 or 2	B	3.0	4.0	1/100
FZ1	3	A	10.0	6.0	1/66
FE16	1 or 2	C	6.5	6.5	1/50
FE21	1 or 2	A	15.0	10.0	1/50
FE17	3	C	30.0	10.0	1/33
FE18	3	A	36.0	20.0	1/20
FE18	1 or 2	B	10.0	20.0	1/20

● *Average temperature rises 55°C. at rated H.P.*



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A HIGH RESISTANCE ROTOR
B LOW RESISTANCE ROTOR
C SYNCHRONOUS ROTOR

● *Full details of these and other F.H.P. Motors can be had in Publication* J 262.

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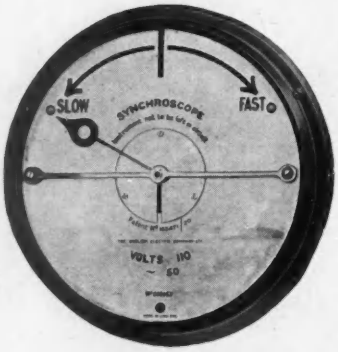
N.C.S. PLATFORM SCALE AMMETER

N.C.S. POWER FACTOR INDICATOR



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THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

London's Oldest Station

Installs World's Most Modern Lighting System

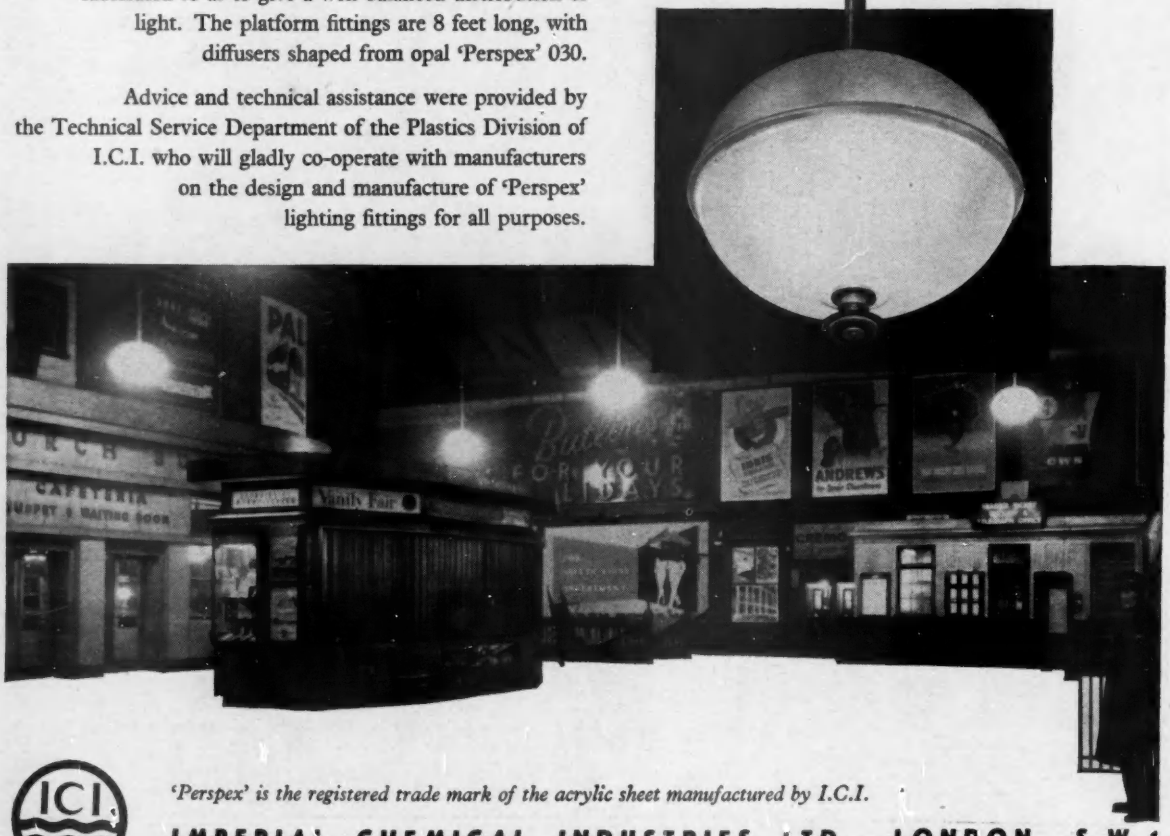
in 'PERSPEX'

Fenchurch Street Station, the oldest in the City of London, has installed cold-cathode fluorescent tubes completely enclosed in opal 'Perspex' acrylic diffusers. These ultra-modern fittings are corrosion-resistant, tough, and very easily cleaned—important practical advantages to British Railways.

The general lighting units consist of two 'Perspex' shapings 37 inches in diameter, the upper in opal 'Perspex' 040 and the lower in 030 designed and fabricated so as to give a well balanced distribution of light. The platform fittings are 8 feet long, with diffusers shaped from opal 'Perspex' 030.

Advice and technical assistance were provided by the Technical Service Department of the Plastics Division of I.C.I. who will gladly co-operate with manufacturers on the design and manufacture of 'Perspex' lighting fittings for all purposes.

All the shaping was carried out by Thermo-Plastics Ltd., Dunstable, and the fittings were made by Ionlite Ltd., a branch of the Falk organisation.



'Perspex' is the registered trade mark of the acrylic sheet manufactured by I.C.I.

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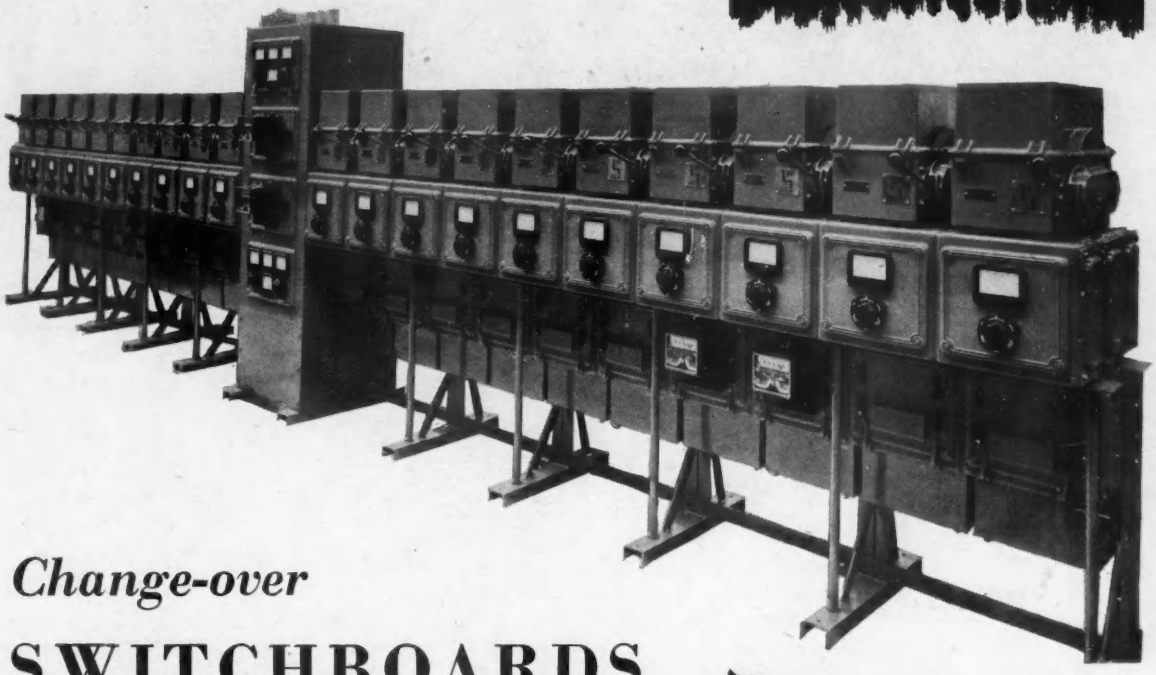

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SWITCHBOARDS

OF UNIT CONSTRUCTION

Low tension duplicate Busbar switchboard with 20 outgoing 300 amp change-over switches to select from main or standby supply.

All outgoing circuits fused and arranged for metering.

The equipment shown above was designed and installed for

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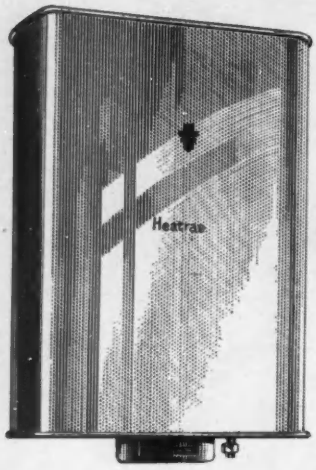
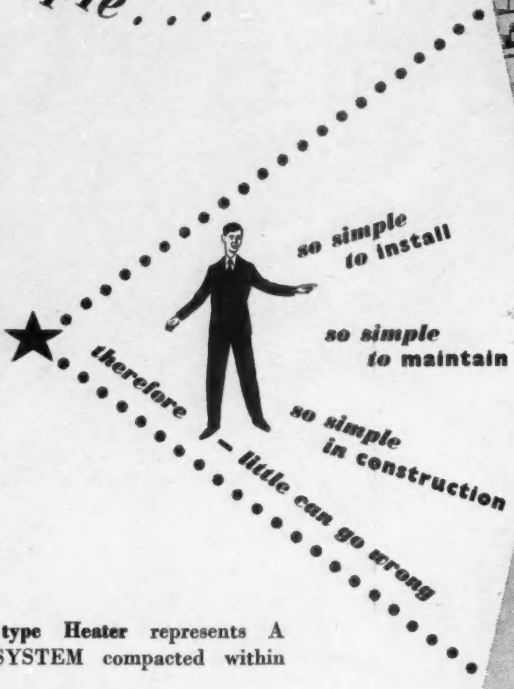
Heatrae *electric water heaters*

are so simple . . .





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It has integral ball-valve cistern, expansion pipe, overflow connection union, etc., for hot water outlet, and is the ideal apparatus for Restaurants, Flats, Offices, etc., where constant supplies of hot water are wanted.

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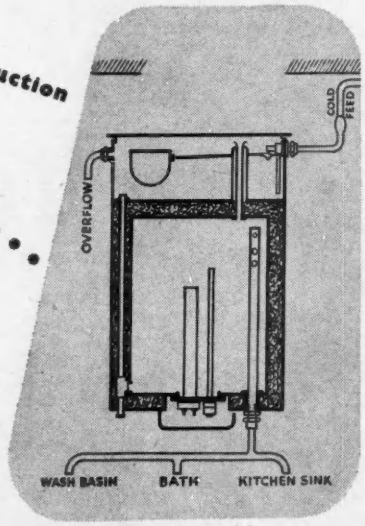
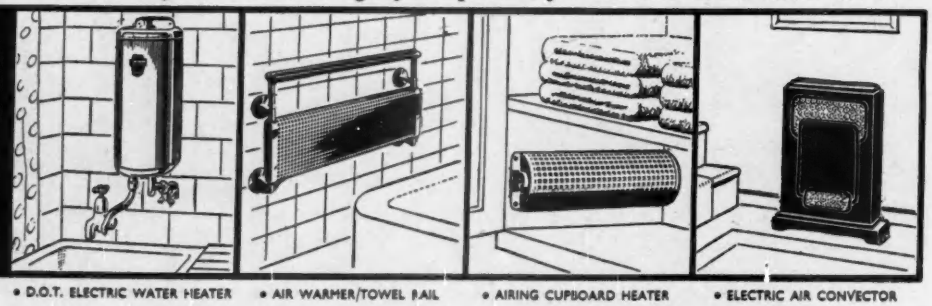


Heatrae

30 years specialised experience in designing and manufacturing of Electric Water Heaters

Here are some of the extensive range of our products for industrial and domestic uses . . .



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* * *

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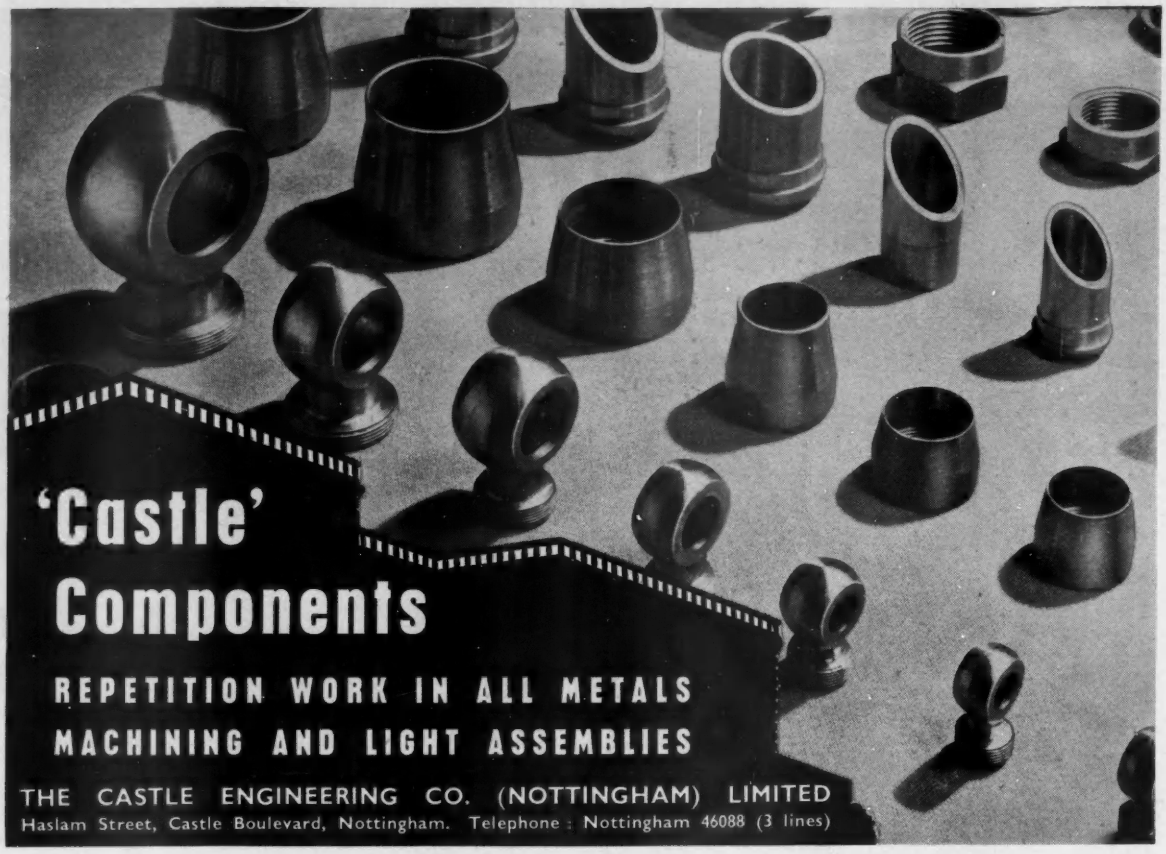
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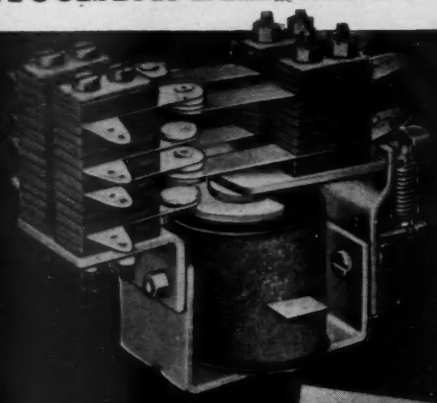

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- pneumatic time delays
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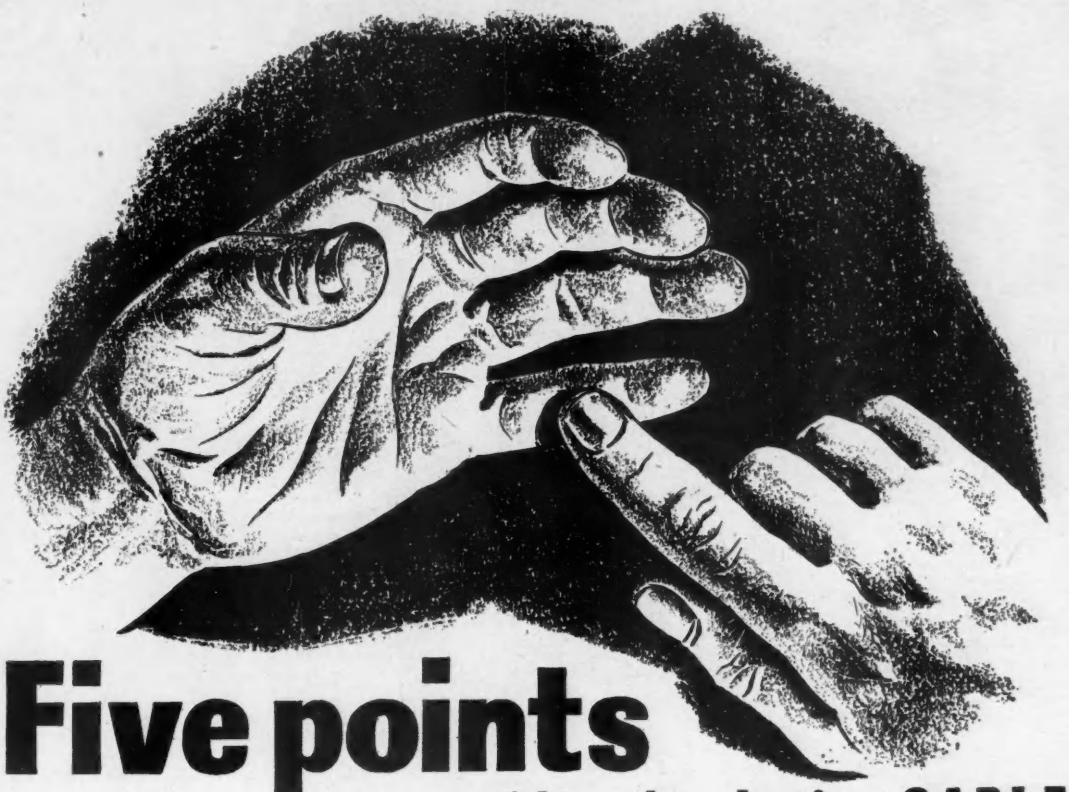

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1 QUALITY — Ashton cables and flexibles are manufactured to a high standard —BSS 7. 1953 under strict laboratory controlled conditions.

2 ELECTRICAL PERFORMANCE — the high grade materials used in Ashton Cables ensure excellent insulation with a high factor of safety.

3 MECHANICAL CONSTRUCTION — Ashton cables will withstand rough handling, and are designed to provide trouble-free service under the most adverse conditions.

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Ashton Cables and flexibles assure you of a trouble-free installation with that ample safety factor which is so essential.

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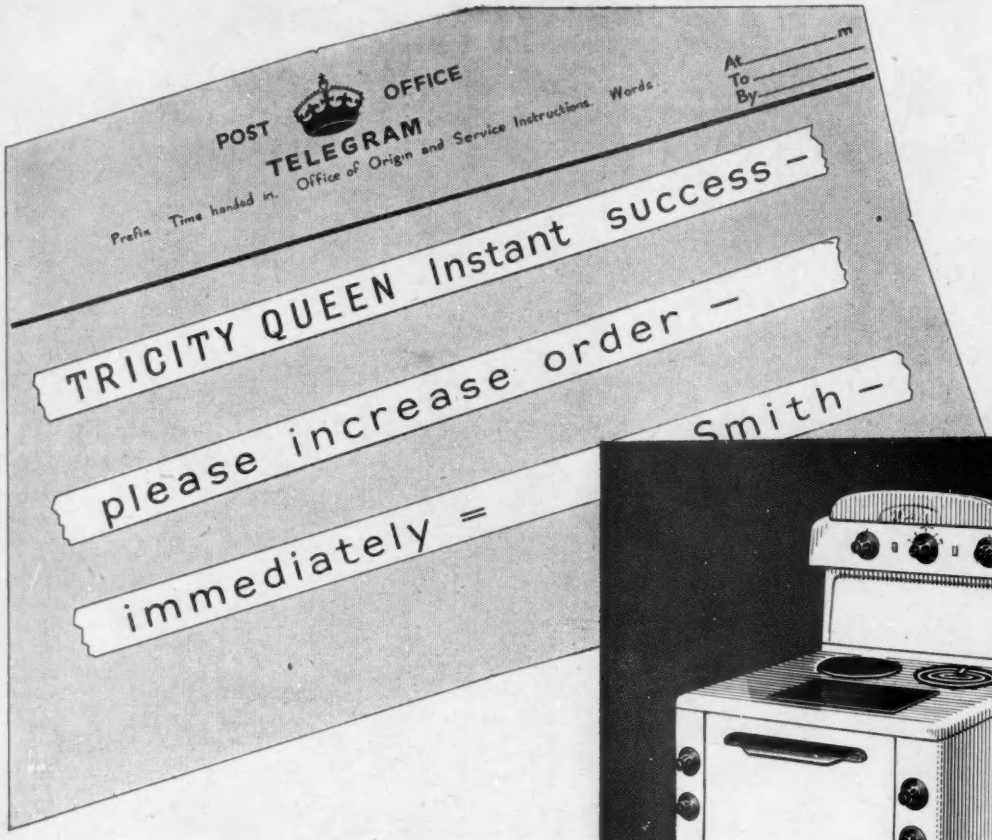

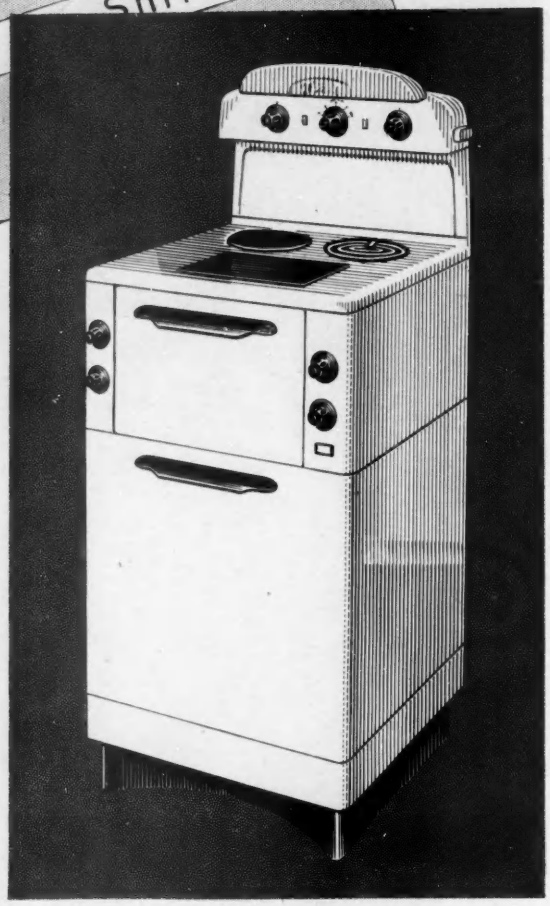

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by

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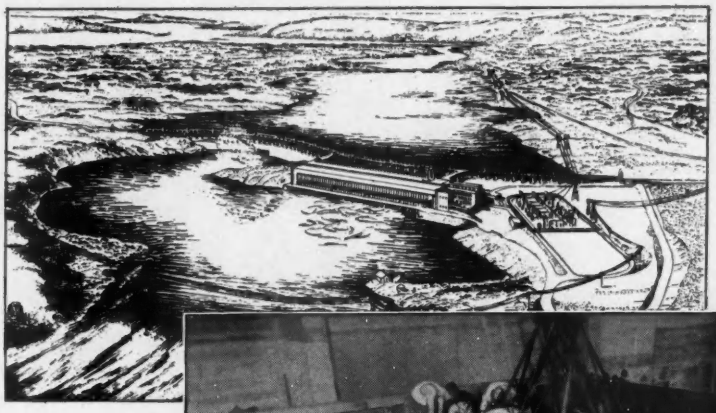

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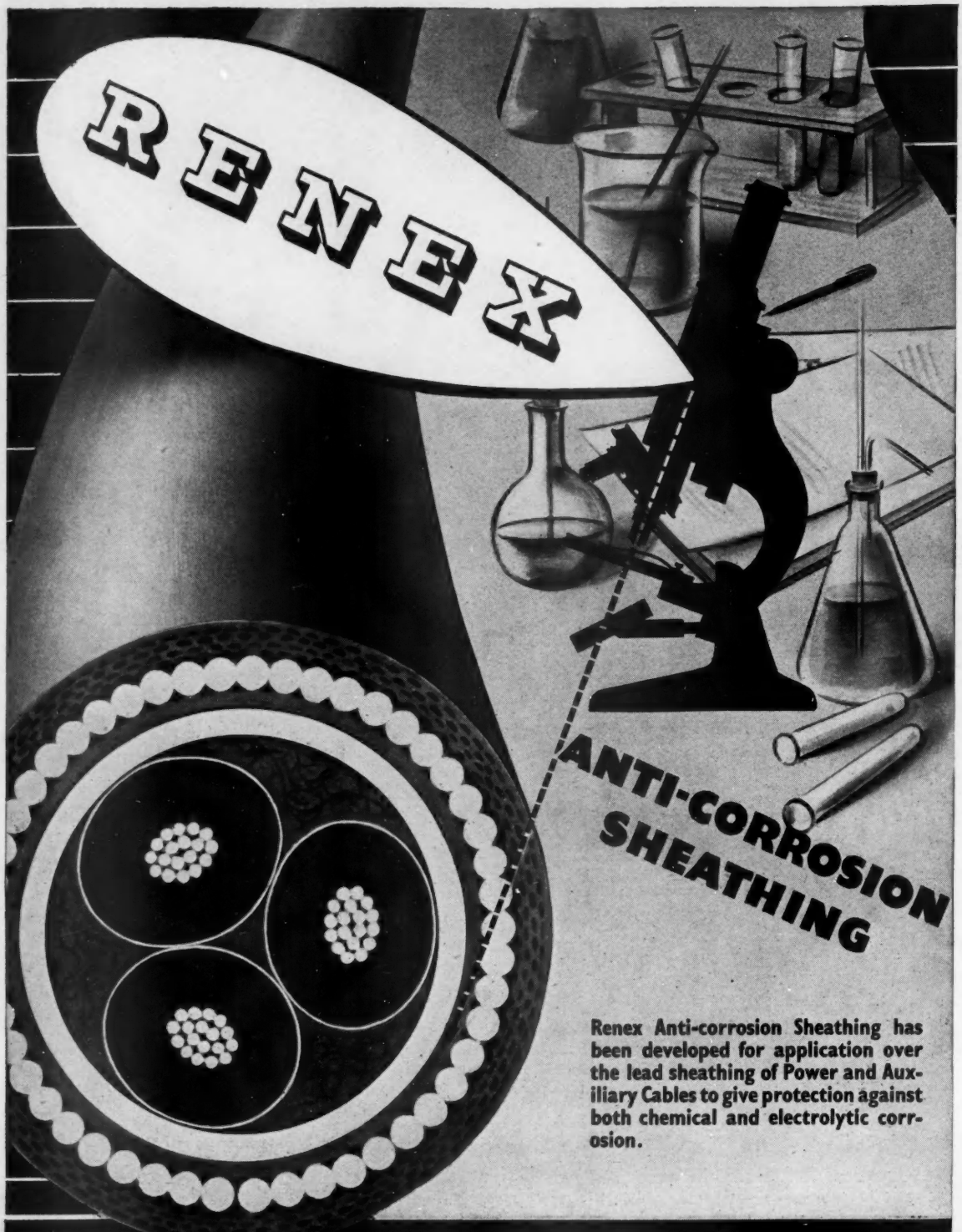
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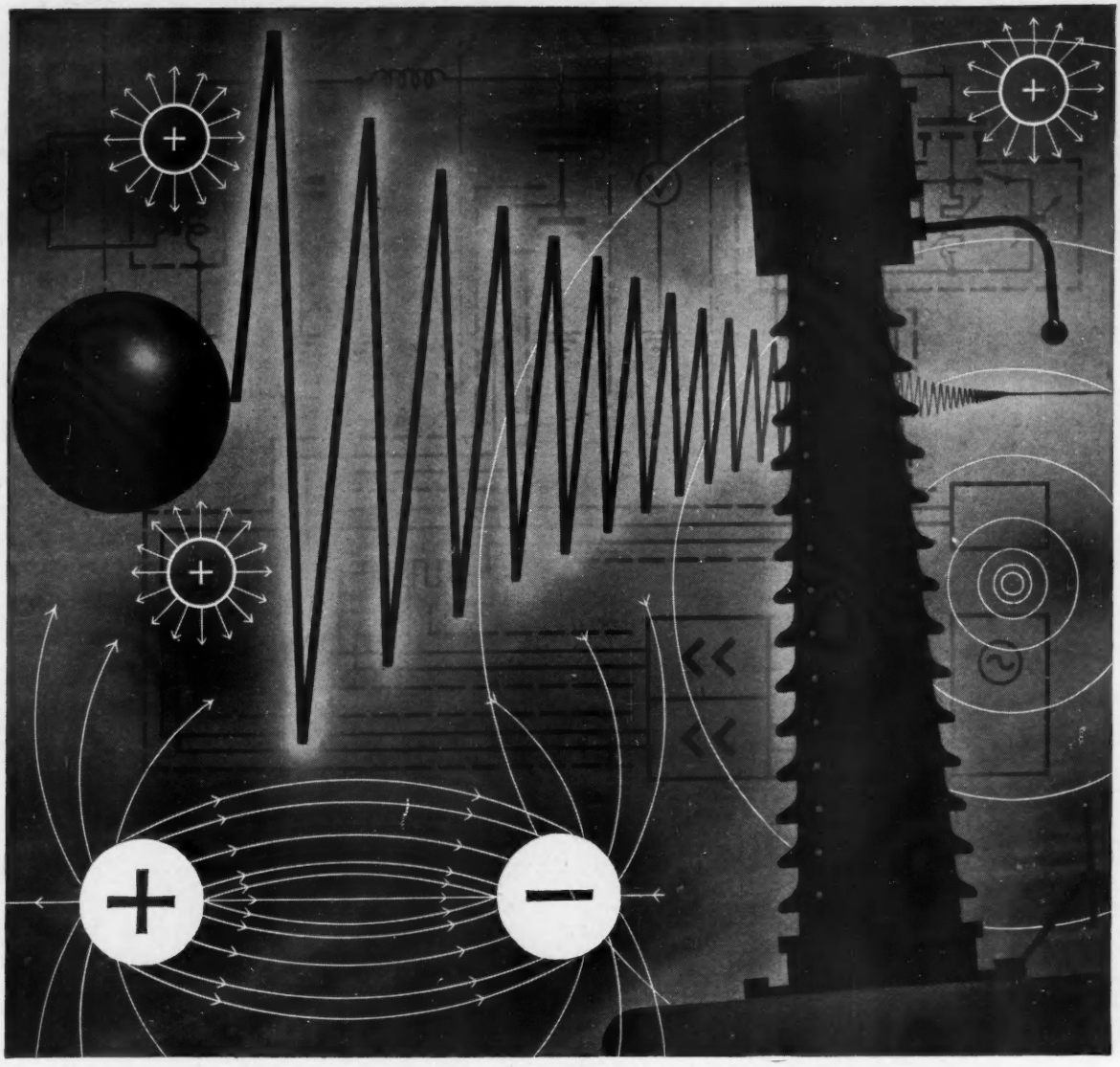

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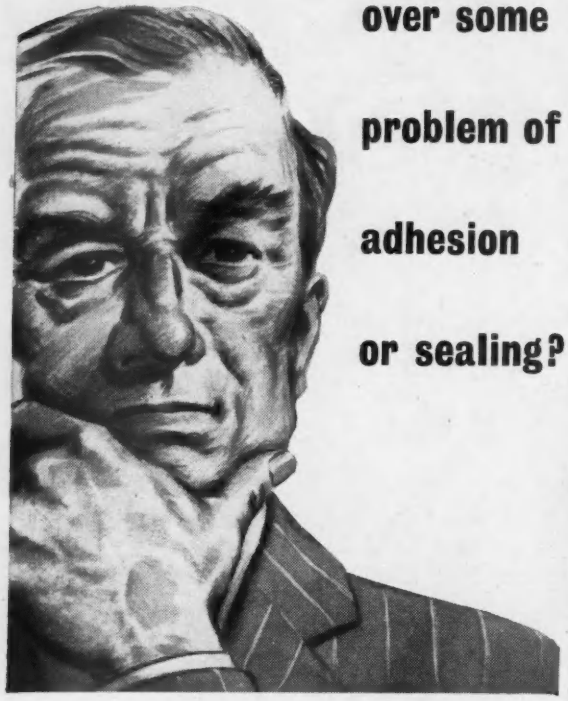

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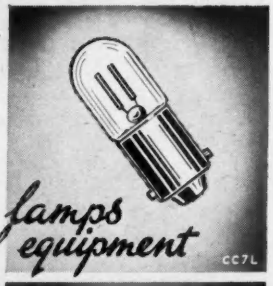

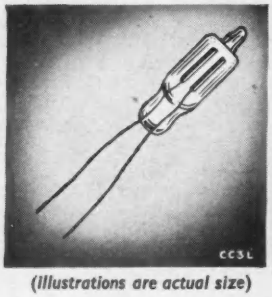

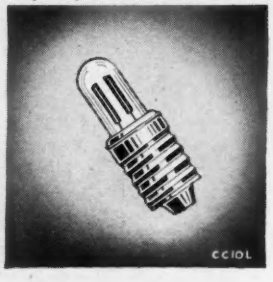

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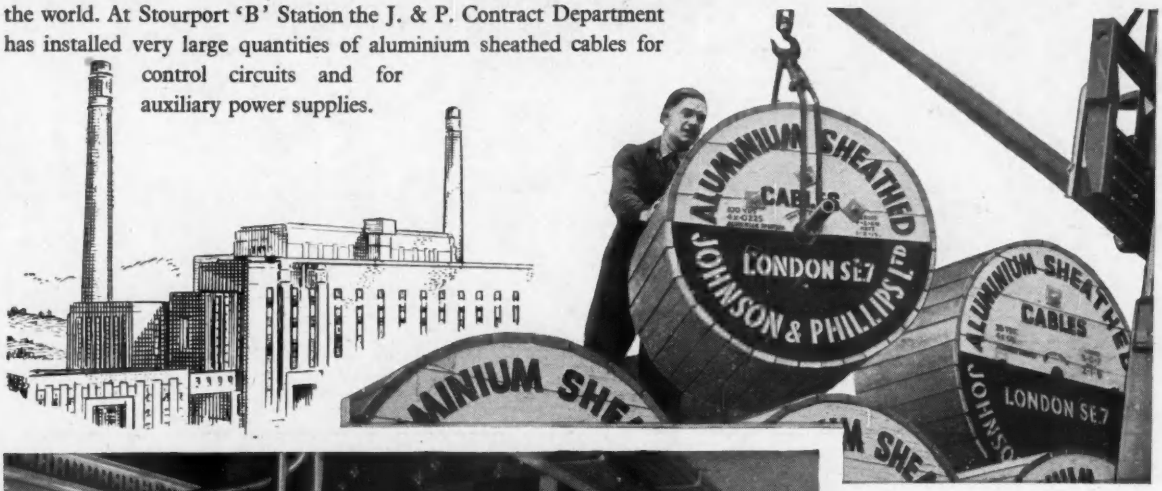

Photographs taken at Stourport 'B' Generating Station.

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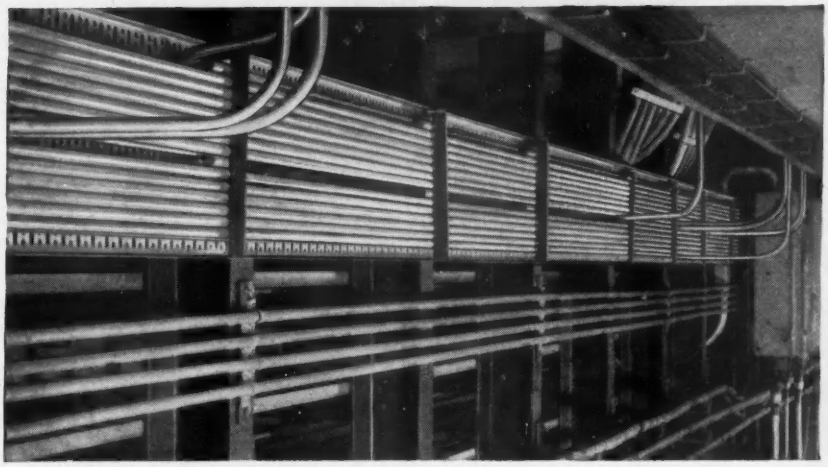
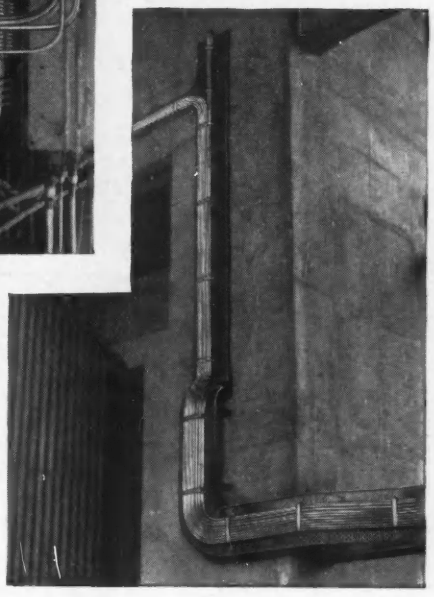


Above: A double bank of thirty J. & P. multi-core rubber insulated aluminium sheathed control cables.



Right: The ease of erection is well illustrated by this run of control cables mounted on perforated trays.

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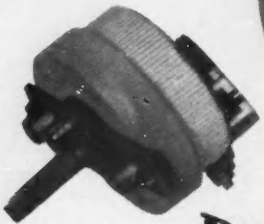

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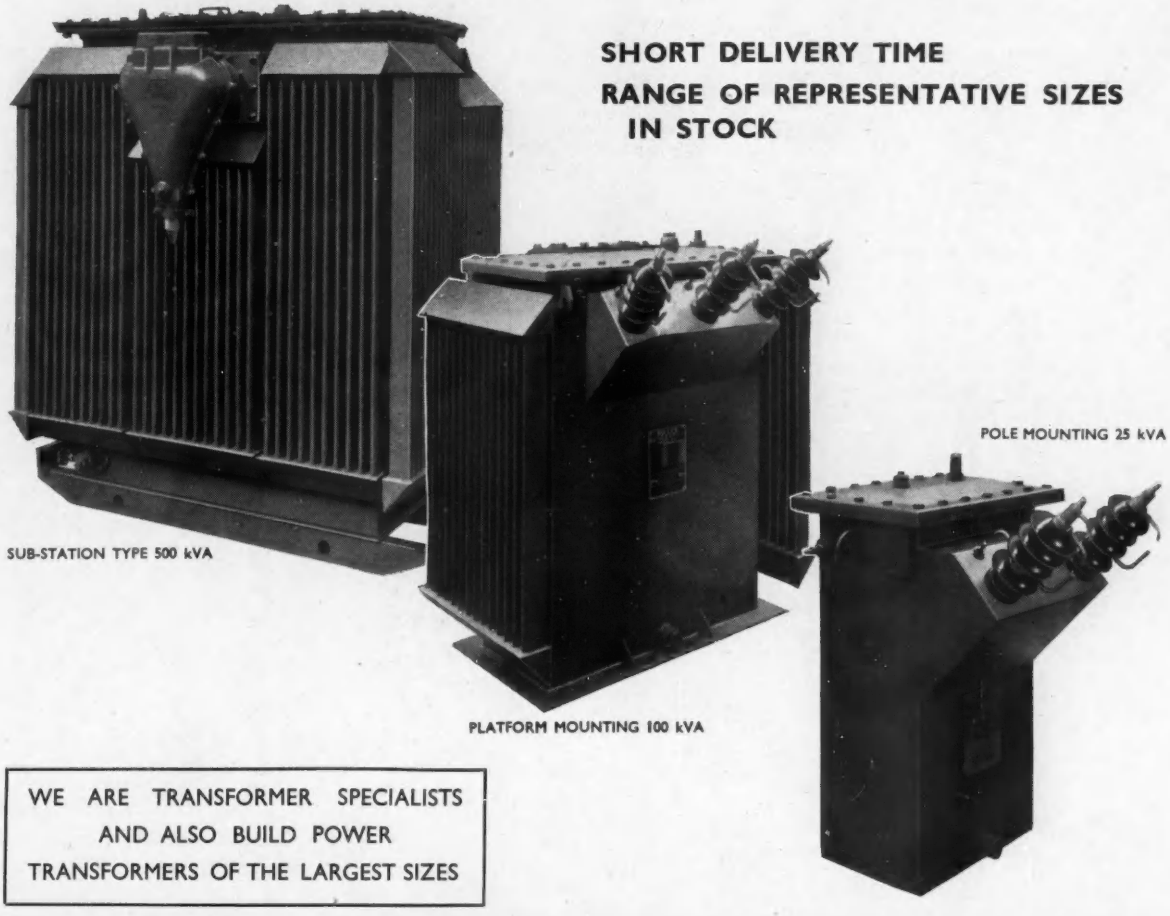

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ELECTRICAL TIMES

THURSDAY, 6 MAY, 1954
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HARNESSING THE NILE

With the formal opening last week by Her Majesty the Queen of the Owen Falls scheme, five years' work, often fraught with danger and anxiety, reached its culminating stage. Much remains to be done before the electrical side of the project can come into full operation, but even at the moment the provision of an electricity supply more than sufficient for Uganda's present needs will have an immediate effect on the economic and industrial life of the Protectorate. Apart, however, from its function as a source of electrical power, the dam is also part of a long term scheme for the control of the Nile waters. This will undoubtedly require a long period in detailed planning and execution, as well as a high degree of international co-operation between the countries affected. At the moment, therefore, and for some years ahead, interest will be directed mainly towards the effective utilisation of the power which the scheme has made available. This new energy source cannot fail to have important sociological results, as the primarily agricultural countries of Kenya and Uganda will be able to attain a fair measure of industrialisation. In connection with this work the Uganda Electricity Board will have a most important part to play in ensuring that, as the Queen said, "the scheme will help you, the citizens of Uganda, to reach the higher levels of health and prosperity toward which you so rightly aspire."

CHANGE IN SHOCK TREATMENT

For many years now, the Schäfer system of artificial respiration has been regarded as the standard first aid method for dealing with cases of apparent drowning or electric shock. It has much to recommend it in this respect, notably the ease with which a lone rescuer can apply it, and the readiness with which it may be learned. Yet medical opinion has for some time recognised that it falls short of the ideal in some important particulars, and more effective methods have been sought. Both in this country and in the United States, the choice has fallen on the Holger Nielsen arm lift system which, as theory suggests and experience shows, offers some important additional advantages, as well as the necessary qualities of ease in application and freedom from any special apparatus requirements. An article on page 665 describes the essentials of this newly adopted technique, and because of its importance, the Holger Nielsen system will in future be described in the well-known ELECTRICAL TIMES wall chart, which is designed for display where the provisions of the Electricity (Factories Act) Special Regulations apply. One point needs

remembering, however, with this as with other systems. Fulfilling the statutory duty to display an instruction card is only the beginning of the task of making full use of the life-saving potentialities of artificial respiration. Periodical drills in the technique illustrated can with great advantage form part of the routine of any electrical department.

ALUMINIUM CABLE FUTURE

Under the influence of the scarcity and high cost of lead immediately after the war, the British cable industry gave close attention to the development of aluminium as a cable sheathing material, with a success that is made apparent by many neat and lightly supported installations in this country and abroad. Six years of operational experience are now available, and so the time is appropriate for the public evaluation of the possibilities of aluminium as a cable material which was undertaken at a meeting of the I.E.E. Supply Section last week. The fact that stood out most clearly from the paper and from the discussion that followed it was that, although for general use aluminium cables are technically satisfactory, they will not normally be selected in preference to lead sheathed designs for such everyday purposes unless there is some price advantage; though special applications present a different picture. This made especially interesting the announcement during the meeting, that a practical method of extruding an aluminium sheath directly on to a cable core has been developed. In the evolution of the aluminium sheathed cable, this obviously convenient method has up to now had to be neglected in favour of less direct techniques such as cold sinking or welding. These served to produce aluminium sheathed cables more quickly than many had thought possible; but it has always seemed probable that the future of the aluminium sheathed cable for the widest applications lay with conventional extrusion methods, once the difficulties imposed by the relatively high temperatures and pressures necessary had been overcome. Because it omits a semi-manufacturing stage, the direct extrusion method may perhaps give the aluminium sheathed cable a sizable price advantage once more for the bread and butter jobs. Yet, however this may be, the aluminium sheathed cable can be reckoned established for many special purposes.

SPENDING ON DEVELOPMENT

Whether industrial undertakings in this country make the best division in their research investment between fundamental scientific investigation and practical development work has been discussed at some length in recent years. Nevertheless, in returning to the subject at last Friday's Electrical Research Association luncheon, Viscount Waverley had some new points to make, as would be expected from one so closely connected with the higher direction of the country's scientific effort. He suggested that too much money is being spent by individual firms in carrying their own fundamental research work wastefully beyond the likely limits of effective results. That firms should tend to do this is readily understandable, for the discoveries of the academic research chemist and physicist have been at the beginning of some of the new industries that in recent years have provided such great opportunities for the very different skills of the industrialist and the design engineer. Viscount Waverley, however, had a reason for his suggestion which echoes a cry that is being increasingly heard: we do not possess the technologists to match the scientists engaged on fundamental research. Without them, the possibilities revealed by the scientific work are unlikely to be perceived, nor will they be brought to fruition. Until the shortage in the ranks of engineers is made good, it is the exploitation of existing scientific knowledge that requires the major effort, rather than any accentuation of further fundamental work.

TYPES IN FUSING

A few years ago, it seemed that the h.r.c. cartridge fuse must drive the rewirable semi-enclosed type from the field, so many technical advantages did it offer. Yet it is a paradox of fuse technology today, that while the h.r.c. fuse is making steady progress into new fields of application, the semi-enclosed type is coming back into favour with engineers for the lower ratings. The crux of the matter is cost; the set of rewirable fuses accidentally blown on a moderate overload in a motor circuit costs only a few pence to replace, against the shillings of the cartridge alternative. Moreover, although rigorous short circuit tests suggest that the rewirable fuse must fail on any severe short circuit, practical experience shows that provided it is installed with moderate discretion, such a fuse lives on to blow another day. Whether this is a demonstration of the excessive severity of short-circuit test conditions compared with actual practice, or merely a reflection of the way in which sharp bends and short lengths of small section cable rapidly increase impedance and drop short-circuit current in a medium voltage circuit, is not clear. It is a subject on which information would be welcome, if some of the work on fuse development could be diverted from h.r.c. designs.

SPEED-UP FOR INDUSTRIAL ATOMICS?

Recent speeches in this country on the development of the peaceful uses of atomic energy suggest that industry and the Atomic Energy Authority are in close agreement without quite realising it. A fortnight ago today saw Mr D. D. Walker, chairman of B.E.A.M.A., calling for greater opportunities to be given to the electrical industry to assist in the development of nuclear methods of power production. A week later, we report in this issue, Sir Christopher Hinton, leader of the Atomic Energy Organisation's production section, felt it necessary in addressing the Institute of Fuel, to stress that industry, via selected firms, will have to take a much more fundamental interest in atomic power station work. The gap in this apparently close-agreement presumably comes in the question of how freely industry is going to be supplied with the information necessary for making a full appraisal of the problem. But if a situation acceptable to both interests can be reached on this question, which is beset with political and international complications, then it seems that we may hope with some confidence for accelerated growth of the atomic energy activities of our great industry.

Meteor

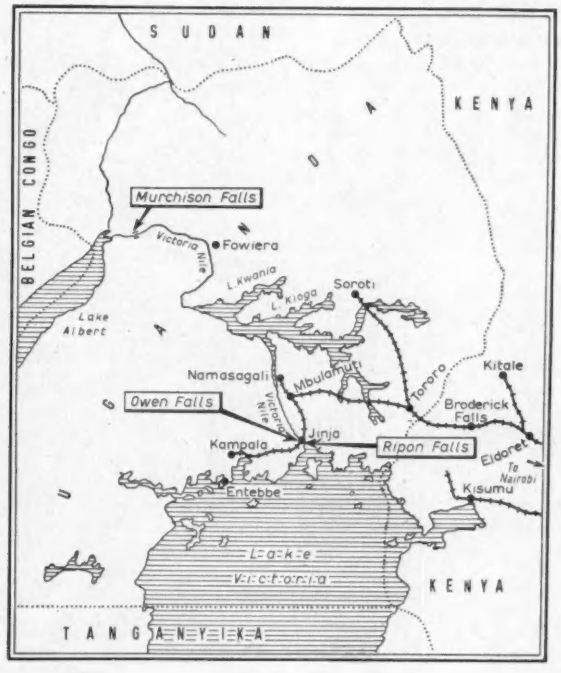
The Owen Falls Hydro-electric Scheme

INAUGURATED BY HER MAJESTY THE QUEEN

29 APRIL 1954

THE opening, last week, by the Queen, of the Owen Falls dam, marked yet a further stage in the taming of the River Nile—on which the prosperity of the Sudan and Egypt depends. Yet apart from the immense water conservation function which is an integral part of the scheme as a whole, the electrical side may well have even more far reaching effects. As the Queen pointed out in her speech at Owen Falls. "It is not yet one hundred years since the source of the Nile was discovered a mile or so from where we are standing now. Today these same head waters have been harnessed for the generation of electric power. By this action, the benefits of modern science have been brought to Uganda and to the industries which are already in being and those which will be established in the future. Without power there can be no economic development; without power no country can go forward in the modern world. Let us not forget that economic development and the building up of power are not ends in themselves. Their object is the raising of the people's standard of living."

Sir Charles Westlake in his speech said that Her Majesty's presence set the seal on the work of many thousands. There had been no labour troubles, and over 2,000 Africans had been employed in addition to over 200 Europeans and Asians. The scheme was a triumph of



Above is an artist's impression of the finished dam and station. Right is shown the location of Owen Falls

An aerial view of the project taken a few days before Her Majesty performed the opening ceremony

British skill in design and execution. The whole of the plant had been imported from Britain. For the last eighteen months, cement had been produced from Uganda's own plant. The scheme was a contribution to the advancement of Uganda as a country's state of development could be measured by the amount of electricity it consumed.

Sir Andrew Cohen, the Governor, welcomed the Queen, and paid a tribute to the work of Dr H. Olivier (Sir Alexander Gibb and Partners) and to Mr Lithgow (Kennedy and Donkin).

The Scheme

Lake Victoria, around the shores of which are the three territories of Uganda, Kenya and Tanganyika, is a vast inland lake in East Africa having an area of some 26,000 sq miles—about the same size as Eire. Water discharged from the Lake, passes down the Victoria Nile, through Lake Kyoga to Lake Albert, on the borders of Uganda and the Belgian Congo. Between the two lakes there is a difference of level of about 1,700 ft in altitude, in the comparatively short distance of 260 miles. At Lake Albert, the Victoria Nile joins with the water flowing from the catchment of the lake and, flowing through the Sudan as the White Nile, joins with the Blue Nile at Khartoum eventually reaching the Mediterranean near Alexandria. The difference in level over the 3,000 mile stretch between Lake Albert and the Mediterranean is only little more than that between Lakes Victoria and Albert.

Following preliminary investigations by Sir Charles (then Mr.) Westlake, Sir Alexander Gibb and Partners, and Messrs Kennedy and Donkin, in 1948, prepared a Report on the prospects of establishing a hydro-electric scheme at Owen Falls, on the Victoria Nile, near Jinja. A dam, on the river, just downstream from the Owen Falls, will raise the level of Lake Victoria by some 4 ft, and provide a net head of water for the turbines of some 63 ft. This main dam will be about 1,200 ft long and 85 ft high. It will be pierced by six sluices, controlled by gates which permit a release of water from Lake Victoria equal to the maximum flow of the existing river. A second dam, immediately behind the power house, will be about 580 ft long.

The hydro scheme is unique in that it is the first step to generate power on such a scale in Central Africa. Indeed, it is of a magnitude greater than any yet attempted in the whole of the Continent of Africa, south of Egypt. The generating plant, at present in course of manufacture consists of six units, each of 15,000 kW capacity. Provision has, however, been made for the ultimate installation of ten such units.

Power Plant

The water turbines, built to the designs of Messrs Boving and Co., Ltd., of London, are of the Kaplan vertical type and each can develop 21,000 h.p. under a net head of water of 63 ft. Normal running speed is 150 r.p.m. The runner has five blades, which can be controlled in pitch by an oil pressure system. Likewise the guide vanes, which control the flow of water to the turbine, can also be altered. Both blades and vanes are under control of an automatic governor. The turbine scroll case has an inlet diameter of some 21 ft and the turbine runner is 13 ft in diameter.

As the generating units may be called upon to run as synchronous condensers, arrangements have been made to depress the water in the turbine runner chamber. This is achieved by admitting compressed air to the runner chamber (after first closing the turbine guide vanes) to "push" the water down clear of the runners, which can then rotate in air thus avoiding churning water with consequent unnecessary power losses.

Alternators

The alternators are being supplied by the British Thomson-Houston Co. and each have a maximum continuous rating of 16,700 kVA at 0·8 p.f., at 150 r.p.m. The output is 50 c/s 3-phase at 11 kV. A stringent specification was adopted, as at the time of design, the final development of the transmission system in Uganda could not be foreseen, and the machines had therefore to meet any possible contingency which might arise. They were thus designed for a short-circuit ratio of 1·6 giving a line charging capacity of 16,700 kVA at zero leading power factor with a substantial margin in excitation voltage, and for a voltage range at the alternator terminals of 11 kV ± 10%.

Other factors which required special consideration were

the high altitude of the power station (approximately 3,700 ft above sea level) and the high ambient temperature likely to be met. These necessitated the temperature rises on full load being kept well below those normally permissible. A large flywheel effect of over 14 million lb-ft^2 (giving an inertia constant of 4·5) is incorporated in the alternator rotor and provides not only satisfactory speed governing, but also stability under line fault conditions. Stability is also assisted by the low transient reactance of 21% and by the use of a special BTH quick response excitation system.

The alternator stator is mounted above floor level, and is completely surrounded by a sheet steel casing, square in shape and about 28 ft across. Level with the top of the casing is a gallery running the whole length of the station on which are mounted the gauge panels, unit starter boards, field cubicles and voltage regulator cubicles.

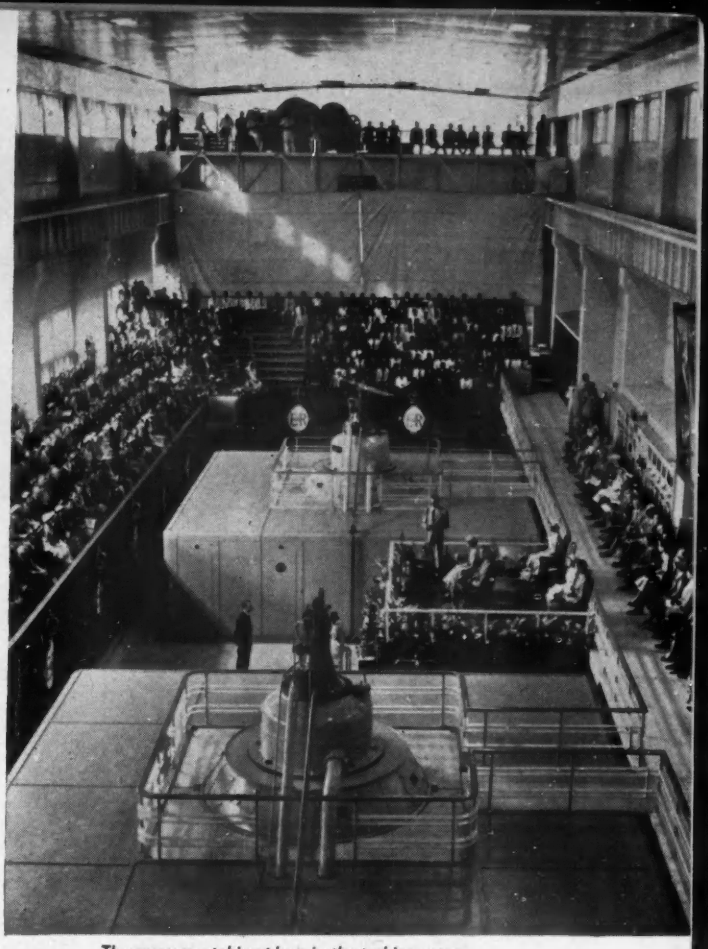
Construction

The alternators themselves are of the umbrella type with with a combined Michell thrust and guide bearing mounted below the rotor and no guide bearing above it. Of fabricated construction, the stator frame was split into four sections for transport to site. Air discharge openings are provided round the periphery, and dovetail key bars fitted inside hold the laminations in place. To achieve high efficiency the laminations are of low-loss, high ductility steel and are insulated on both sides by the flash-enamel process to reduce eddy currents. Steel fingers, welded to segmental-steel flanges, support the core teeth.

A short-pitched double-layer lap type winding has been used, as this form of construction reduces the lower harmonics. Radial shaping of the air gap, and the choice of the appropriate number of slots have been utilised to reduce the higher harmonic content. The winding consists of two circuits in parallel per phase, and all six ends are brought out by flexible leads. In order to reduce further, eddy current losses, one turn in each coil is transposed in the end winding.

Rotor Design

The rotor comprises a shaft, a fabricated spider, a rotor rim, and poles; the spider—which was shipped in two sections—being bolted to flanges on the shaft. Keyed to the spider is the rotor rim, built up of segmental steel plates, interleaved and bolted together in two sections. Owing to transport difficulties, the individual plates had to be shipped loose and the whole rim built up on site. The pole laminations are clamped between forged steel end plates and the completed poles fitted in "T" headed slots in the periphery of the ring and secured by tapered keys. The complete rotor weighs about 130 tons and is just over 19 ft in diameter. Overspeed tests have shown the rotor to be capable of withstanding the stresses which occur at the runaway speed of the turbine. A duct through the centre of each pole ensures a supply of cooling air from the integral fans. Below the spider rim is a circle of segmental brake plates, and against these press the combined brakes and jacks which are mounted on the



The ceremony taking place in the turbine room

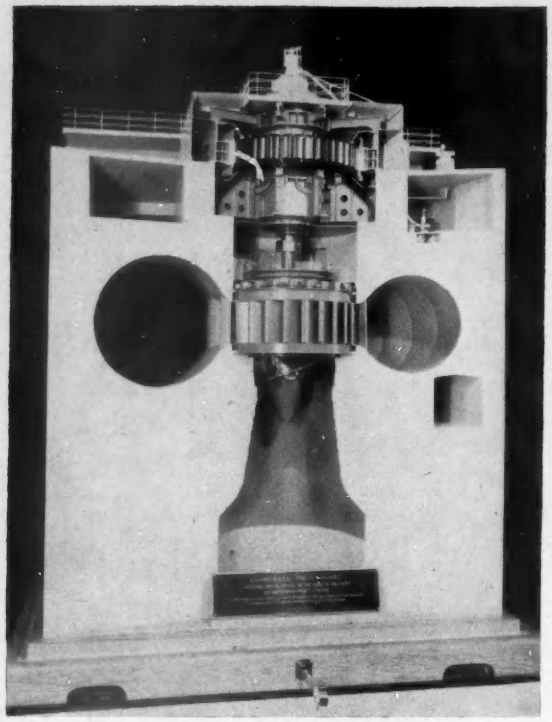
The scene inside the power house when the Queen opened Owen Falls Dam at Jinja. With the Queen and the Duke on the dais is Sir Charles Westlake

arms of the bearing bracket. The pistons of these brakes and jacks can be locked in any position by rotating a loose ring round the cylinder. When used as brakes they are operated by air supplied from an electrically-driven compressor, two of which are supplied as station auxiliaries by the Westinghouse Brake and Signal Co. When, however, they are used as jacks, power oil is supplied from a portable electrically-driven pump.

On the first two alternators, the rotor coils were machine wound, but on the remainder they are of fabricated construction. The major insulation is of Micanite, mechanically reinforced with varnished pressboard and the winding is supported by flanges of moulded insulation. A short-circuited winding of copper rods in semi-closed slots is provided in the laminations near the pole faces, to damp any oscillations which may be generated by disturbances on the system, to prevent hunting and to reduce harmonic voltages under unbalanced load conditions.

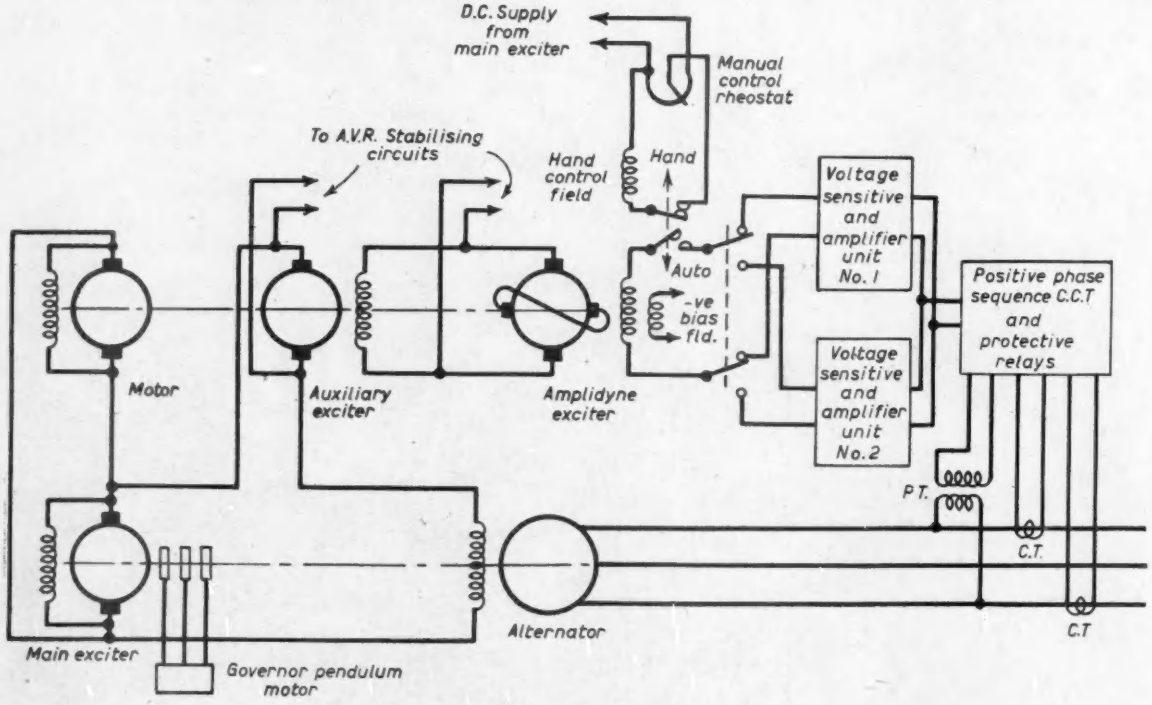
The bottom bracket which houses the combined thrust and guide bearing consists of a hub with eight radial arms bolted on. The maximum load carried by the thrust bearing, including the hydaulic thrust is 465 tons, and the thrust and guide bearing parts are submerged in a bath of oil, the lubricant being circulated through an external cooling system. A 7½ h.p. a.c. motor-driven pump performs this duty, with a similar pump driven by a 240 V d.c. motor acting as standby. The pumps are supplied by Messrs Mirrlees (Engineering) Co., Ltd.

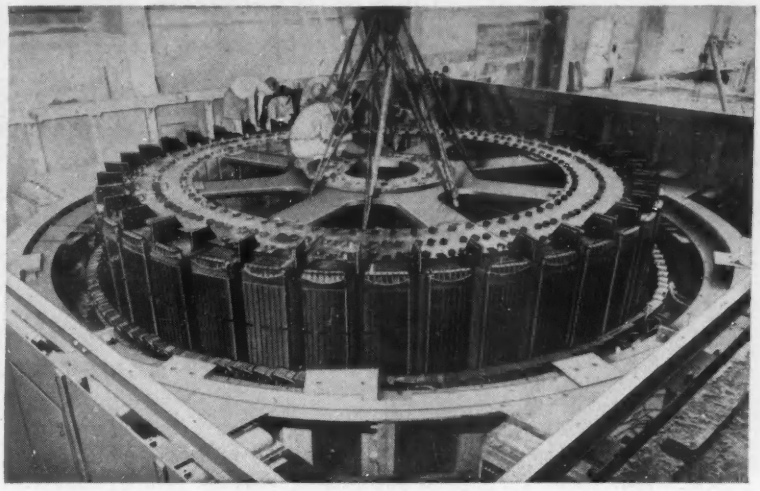
The top bracket consists of a hub and eight radial arms which span the top of the stator. This bracket carries the magnet frame of the main exciter and supports the top portion of the outer casing. Ventilation of the machine is on the closed-circuit system, the circulated air being cooled by eight air/water heat exchanges arranged in pairs at the four corners of the square formed by the outer casing. An electrically-driven fan, mounted between two arms of the top bracket, forces cooled air from the alternator system through a duct into the main exciter.



This model, made by Bassett-Lowke Ltd., shows the arrangement of the water-turbine and alternator

Below is a schematic circuit diagram to show the unusual excitation system adopted in the station





Lowering the rotor into the stator of one of the B.T.H. alternators

Excitation

An unusual excitation system has been adopted. The main exciter consists of a self-excited, compound-wound, d.c. generator having a specially-designed magnetic circuit so that the variation in exciter flux with change of speed is small. Three sliprings connected to tappings on the armature provide a 3-phase 15 c/s supply for the governor pendulum motor and the voltage regulator power supply. A motor-operated rheostat is connected in series with the main exciter shunt field to take care of initial adjustments and abnormal operating conditions.

The auxiliary exciter set, which runs at 1,000 r.p.m. comprises an auxiliary exciter and amplidyne generator, driven by a d.c. motor which receives its supply from the main exciter. The auxiliary exciter is connected in series with the main exciter armature and is arranged to buck or boost the output voltage of the main exciter, thus supplying a variable voltage supply to the alternator field. Excitation of the auxiliary exciter is provided by the amplidyne, which in turn is controlled by an electronic voltage regulator. Two field switches are housed in the field control cubicle and, when opened, suppress both the alternator field and the main exciter field. To ensure that on starting the main exciter voltage builds up at a suitable rate, an auxiliary field has been provided which is connected through a contactor to the 240 V station battery. This contactor is closed before starting up, and is opened by a current relay as soon as the main exciter shunt field current has reached a preset value.

A possibility which had to be considered with this system, was that of the turbine accelerating at a faster rate than the excitation build-up. In this event, the pendulum motor might not reach synchronous speed by the time the main alternator was running at synchronous speed, and the set would therefore continue to accelerate. An alarm circuit, utilising a voltage relay and a speed relay is included to detect this condition, but from tests already carried out the possibility appears to be remote.

The voltage regulator, housed in a separate cubicle, employs a saturated diode, which forms part of a bridge circuit supplied from the alternator terminals through a voltage transformer. Any deviation in the bridge output is amplified, and influences the alternator excitation through the medium of the amplidyne and the auxiliary exciter in the correct sense to restore normal voltage. Positive phase sequence networks ensure correct voltage regulation under unbalanced loading conditions, and compensation circuits provide satisfactory reactive load sharing between alternators running in parallel. The electronic control circuits are duplicated and fault discriminating relays are provided to give automatic transfer from a control unit, which may develop an internal fault, to a standby unit. In the event of an external fault, such as a failure of the potential transformer supplying the regulator, hand control is automatically introduced. To prevent hunting and to ensure optimum rate of recovery following load changes on the alternator, transient negative feed-back voltages, derived from the auxiliary winding are fed into the amplifier. The speed of response of the system is high, since control is effected through a high-speed auxiliary exciter instead of a relatively large low-speed main exciter. In the event of line faults, full ceiling volts are available as the supply to the auxiliary exciter set driving motor is unaffected by the line conditions.

Control

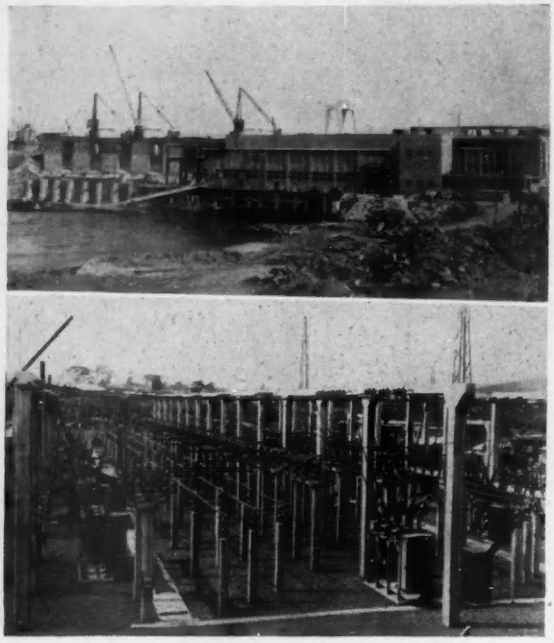
Fundamentally, the control gear is designed for hand operation, although certain automatic features have been incorporated. The gauge panel and unit starter board are mounted together, thus forming a complete control board. Illumination of the panels is provided by a fluorescent lighting system. The starter board houses the incoming 415 V a.c. power supplies from both the station 500 kVA 33 kV/415 V auxiliary transformer and the 50 kVA 11 kV/415 V unit transformer, together with the 240 V d.c. supply and the starters for the various unit auxiliaries.

On starting up from the unit supply the alternator bearing and the turbine bearing d.c. driven standby pumps, are run up from the starter board, and the contactors controlling the other a.c. auxiliaries closed. The turbine can be started by pressing the "start" button on the gauge panel, which disengages the guide vane lock and then running the load limiter toward the "open" position by the control switch on the gauge panel. As the machine runs up to speed and the voltage of the unit transformer increases, the motors driving the governor and main bearing oil pumps also run up and automatically take over the loads of the standby pumps. When the set is running down, the standby pumps automatically come into play again, as the main pump pressure falls.

Alarm signals from the alternator transformer, the alternator itself and the turbine are indicated on a 6-way alarm facia provided on the gauge panel, and certain individual and group signals are relayed to the control room. A telecommand receiver and sender switch, together with a telephone are also provided to allow rapid communication to be established between the turbine driver and the control room. This equipment has been supplied by Standard Telephones and Cables Ltd.

Transformers

The alternator voltage is 11 kV, and each generator is directly connected to a Bruce Peebles 16,670 kVA 11/33 kV, 0·9 p.f. delta/star connected oil-immersed water-



The power house and intake dam with, below, a view of the switching station, looking north, showing G.E.C. oil circuit-breakers

cooled transformer. The four main generator transformers installed are of the conventional core type, with vertical legs provided with transverse oil ducts. They are equipped with duplicate forced-oil coolers to provide 100% standby facilities, one complete cooler with its totally submerged motor-driven oil pump being located at each end of the transformer. Each pump is capable of dealing with full load cooling requirements by forcing oil through the Serck cooler. Two additional 16·67 MVA 11/132 kV generator transformers are also being supplied by Bruce Peebles.

An overhead transmission line from Owen Falls power station to Kampala is fed by 7,500 kVA 33/66 kV outdoor oil-immersed, naturally-cooled transformers fitted with detachable radiators, each of which has a hand-operated inlet and outlet valve. A reactor type motor-operated on-load tap changer on the 33 kV side gives voltage variation of ±10% in 16 steps of 1¼% each, all tappings being fully rated.

Switchgear

Electrical equipment for a 33 kV outdoor substation consisting of fourteen bays has been supplied by the General Electric Co., Ltd. The twelve frame-mounted 33 kV outdoor circuit-breakers have a breaking capacity of 750 MVA at 33 kV, and a full load current rating of 800 amp. Each breaker consists of three separate double-break low-oil-content single-phase units mounted in steel tanks and supported by a steel framework. This form of construction permits inspection of the contacts without the necessity for removing oil from the tanks or breaking oil-tight joints, and a single phase of the breaker can be removed bodily and replaced by a spare unit at any time. Of the 45 rotary isolators in the station 43 are for 33 kV and two for 66 kV.

Design of the protective gear, also by G.E.C. is in accordance with standard practice for hydro-electric generating plant the most notable feature being the use of 63·3 ohm resistors for earthing the generator neutrals. This limits the fault current on the 11 kV side to 100 amp. Lighting of the entrance hall, conference room and control room at the power station was designed by the G.E.C. in conjunction with the consultants for the whole scheme, Sir Alexander Gibb and Partners, the electrical contractors being Electrical Installations Ltd.

Transmission

As part of the general scheme, the British Insulated Callender's Cables group are erecting the first 132 kV overhead transmission line in East Africa. About 113 route miles in length it runs from Owen Falls to Kampala, and from Owen Falls to Tororo. This latter section will form the first link in the long distance transmission scheme for connecting up the power station with Nairobi.

The generator cables from each set consist of two single 11 kV B.I.C.C. cables per phase, protected by a water and fire-resisting serving where they are laid internally and a water- and termite-resisting serving over the external portion. These cables, connecting the alternator line cubicles with the switching station, are laid in a cable tunnel running the length of the power station, at the foot of the intake dam, and terminate in outdoor sealing ends which are directly connected to the transformers.

Single-core 11 kV cables have also been used to connect the alternator line cubicles with the 50 kV auxiliary transformer installed for each generator, and altogether some 2½ miles of B.I.C.C. single-core cable are being laid in this first stage of the work.

The control room is situated at the switching end of the power station and the control cables run from the control room to the generators and switching station. About 7 miles of 250 and 660 V multi-core paper-insulated, lead-sheathed and steel wire armoured cables together with several miles of rubber insulated cables have been supplied for control purposes. In addition local distribution within the power station required over 3 wires of 660 V cables, and these, together with the other paper-insulated cables installed, are of the mass-impregnated non-draining type.

Civil Works

The civil engineering work, representing about £5½ millions of the total cost of some £16 millions is being carried out by the Owen Falls Construction Co., an international consortium comprising the British firms of Dorman Long, Edmund Nuttall Sons and Co., J. L. Kier (London), Christiani and Nielsen, together with four Dutch firms. Many problems had to be solved including the sealing of faults in the river bed, and the insatiable curiosity of wild animals created unexpected difficulties. Much preliminary work was carried out on hydraulic models at Imperial College, London.

The important sluice gates, which will control the waters of the Nile were made by Glenfield and Kennedy. The whole of this great project is being undertaken by the Uganda Electricity Board, under the chairmanship of Sir Charles Westlake.

List of Main Contractors

Civil Works	Owen Falls Construction Co.
Generators	The British Thomson-Houston Co.
Turbines	Boving and Co.
Switchgear and Control Gear	General Electric Co.
Transformers	Bruce Peebles
Cables	British Insulated Callenders Cables
Compressors	Westinghouse Brake and Signal Co.
Pumps	Mirrlees
CO_2 Fire Suppression	Pyrene Co.
Signalling Systems	Standard Telephones and Cables
Sluice Gates	Glenfield and Kennedy
Consulting Engineers	Sir Alexander Gibb and Partners, Messrs Kennedy and Donkin.

Other contractors include Edison Swan, Clifford and Snell, E.M.P. Electric, Ferranti Ltd., Line Equipment, Reyrolle, Rheostatic Co., S'mmonds and Stokes, Hartley Electromotives Ltd. and Electrical Installations Ltd.

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Sockets and Standards

MR T. C. Gilbert's article on "Sockets and Standards" in your issue of 8th April prompts me to make the following observations. First, B.S. 1363 is applicable to *a.c. supplies only*, and second, there are still a great many "pockets" of d.c. supply in Britain and the gradual changeover is likely to be very extended—if progress in this area is any criterion.

Therefore, although I am greatly in favour of the general adoption of B.S. 1363 it is unavoidable that contractors must install sockets to B.S. 546 wherever the supply is d.c.

This practice is invariably much more expensive than an equivalent installation to B.S. 1363 as to comply with regulation, every 5 and 15 amp socket has to be on a separate circuit and fuse, and I feel this is somewhat unfair especially as most of the best domestic equipment and appliances are a.c. only.

The solution appears to be completion of changeover to a.c. at the earliest opportunity and then to penalise the installation of B.S. 546 even more than at present before taking any steps towards compulsion—of which we have had more than enough one way or another.

A. G. Tustain,
SHEERNESS, KENT.

* * *

Static Electricity

I READ with interest Mr Swann's letter on static electricity and welcome his lead in seeking your readers' experience and views on this subject.

My search for information concerning what circumstances determine which substance would become negative and which positive on electrification, lead me into the atomic structure of the substances involved. Finally, it appeared to resolve itself as follows. The substance of the higher dielectric resistance is always positive and the other substance from which the first has been in intimate contact and subsequently separated having a lower dielectric resistance, is negative.

The answer to Mr Swann's inquiry as to which would be positive and negative when a locomotive isolated upon non-conductive rubber tyres from the earth becomes electrified on blowing off steam from its safety valve is:

The boiler valve being one contact substance and without doubt the lower dielectric constant substance, would be negative, the steam on leaving the seat of the valve at high velocity, becoming super-heated on release to atmosphere, is at that point a very dry gas possibly with a dielectric resistance of 10^{12} ohms, in consequence would be positive.

If similar electrification could be induced with an insulated steam whistle, which I very much doubt, the signs would remain true to the formula given. In all static electrification the speed of separation is a determining factor on how many electrons are entrapped and consequently on the value of the ultimate charge.

I am not quite clear about Mr Swann's statement that because sparking occurs between the boiler and earth when steam is escaping, the boiler must be of opposite sign to earth, surely sparks would occur whether the charge on the boiler is a few thousand volts positive or negative?

Mr Swann's reference to the possibility of modern multi-jet aircraft generating static electricity upon their fuselage to a considerable extent and his acknowledgment that during his vast experience in this subject he has not read or heard about any experiments to determine data of static generation in this way, makes one wonder whether, in fact, this subject has been fully investigated. From present-day knowledge it is apparent, as stated by Mr Swann, that the flight of multi-jet aircraft at high speed must be an ideal method of generating static electricity and what appears to make the possibilities even more startling is the fact that both the passage of dry air over the fuselage and the hot gas discharge from the jets will both induce a charge of the same sign of negative character. If these possibilities are indeed fact, what kind of voltage would be attained climbing to high altitudes where the leakage to atmosphere would, no doubt, be considerably reduced? How would this charge behave if it happened to approach a heavily-charged gas pocket at opposite and positive potential?

K. C. Magee,
ROCHFORD, ESSEX.

* * *

Looping-in at Switches

IT is somewhat surprising to find that "Megohm" in his notes of 22nd April should describe as an "Unusual Installation" the method of wiring he discovered upon inspecting an installation with looping-in at switches, and also oppose it without, it would appear, going into the question more deeply.

This is by no means unusual. I have practised it myself for over 25 years and know many others in various parts of the country who do so, in fact, I should call it an established practice amongst competent electricians. It is often an advantageous method of wiring when carrying out surface work, or when the feed cables approach from the switch direction, it is a great saving of cable and avoids the use of an unsightly junction box.

To my mind a blank switch terminal for connecting the neutrals at a switch is preferable to using a loose porcelain connector, and will certainly register a better insulation test.

I am at a loss to know why intermediate switches were used in the instance described by "Megohm." An ordinary two-way switch with the contacts, not required for operating the switch as a one-way, removed from the terminal will provide a suitable connecting point for neutrals.

Switch manufacturers will gladly supply loop-in switches for this purpose, as an example, my present stock includes several loop-in pull switches, but normally we convert two-way wall switches as required. I would also suggest that the intermediate switches used on the installation in question were not the usual type, by the fact that they do not appear to have been fitted with an insulated cover on the inside of the metal switch cover.

Furthermore, the modern method of fixing most switch covers is by screws, which removes most of the danger of unauthorised persons tampering with the live terminals, and is on a par for safety with the standard types of sockets.

M. Broomfield,
PYWORTHY, DEVON.

Megohm hopes to return to this subject in his "Notes on Wiring" at an early date.—Ed.

Aluminium Sheathed Cables

SIX YEARS EXPERIENCE REVIEWED AT I.E.E. MEETING

IMMEDIATELY following the 1939-1945 War, the British cable making industry gave intensive attention to the possibility of using aluminium as a cable sheathing material in place of lead, which had become irregular in supply and extremely expensive. In a paper presented to the I.E.E. Supply section last week Messrs P. M. HOLLINGSWORTH, M.ENG., M.I.E.E., and P. A. RAINE, F.R.I.C., review developments since that date, particularly in the light of the experience of Johnson and Phillips Ltd.

Aluminium is the first choice after lead and copper for cable sheaths and conductors, particular advantages being its light weight combined with low resistivity, and high mechanical strength. Contrary factors, however, are a high melting point and a chemically reactive nature. The former discourages sheathing processes and the latter introduces jointing and corrosion difficulties.

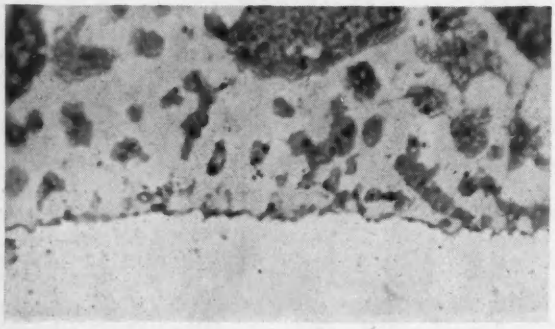
So far, most work has been carried out on aluminium sheathed cables with copper conductors. In spite of technical attractions, the case for aluminium rests largely on economic considerations. On a volume basis—cost per cu ft—it has in recent years been one-third or less of the price of lead. Aluminium is in plentiful supply, and even a complete change by the cable industry to aluminium sheathing would be unlikely to affect this condition.

The grade of aluminium most widely used for cable sheathing has 99·5% purity. This can be produced by a continuous process, while the 99·99% "super-purity" aluminium, which is softer and more ductile, and is so attractive for direct extrusion, can at present be produced only by a more costly process of limited output.

Corrosion and Soldering

Aluminium holds a low theoretical position in the electrochemical series, but the oxide film which forms on its surface considerably modifies the effects of this. For cables in air, prolonged outdoor exposure in most industrial areas produces only a dark patina on the metal without measurable depth of attack. The effects of contact with zinc, tin or iron are negligible. Only in marine conditions or contaminated industrial atmospheres are special precautions demanded.

Alkalis present some problems, but tests on aluminium embedded in Portland cement, and stored in damp conditions, have demonstrated that corrosion during setting of the cement is unlikely to be serious, and that thereafter it practically ceases. When aluminium is embedded in plaster, the corrosion is usually less than in cement, but surface contact with walls that are not painted or otherwise moisture-proofed is liable to be dangerous.



2,000 × full scale section through interface between aluminium and wipe using 90 : 10 tin-zinc tinning metal and 35% tin wiping metal

Cables underground are a different matter. Where there is a risk of contact with natural waters, corrosion considerations prohibit altogether the use of bare aluminium. Since the one known common factor necessary for corrosive attack to occur is access of moisture to the aluminium sheath, elimination of this risk entails provision of an impervious layer of chemically inert material.

Soldering, the other essentially chemical problem, is undertaken by the authors by the method of abrasion tinning of the sheath, using a 90% tin, 10% zinc alloy (melting range, 195-198° C.). The coating so applied will accept standard grades of wiping metal to form a strong and permanent union with the sheath.

Sheathing Processes

Three main methods of sheathing with aluminium were investigated after the war: direct extrusion, the welded sheath, and the tube sinking process. The first of these methods suffers from the temperature limitations imposed by the cable insulating papers. This leads to the need for higher pressures than those used for extrusion of the tube alone. Press design for long continuous lengths of cable is, moreover, likely to be difficult. Nevertheless, the system offers an opportunity of low running costs when compared with alternative methods, though the high capital cost of press installations might offset these. However, several large extrusion presses have been designed and are now on trial.

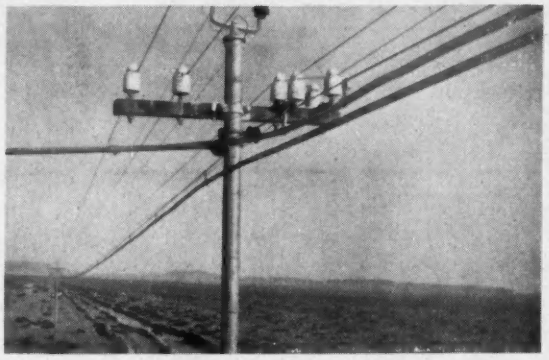
Welding, using the argon-arc process, has been used in conjunction with simultaneous reducing operations to bring down tube dimensions. Apart from mentioning this, the paper does not deal with this process, but devotes itself exclusively to the product of the tube sinking process. This was described in the ELECTRICAL TIMES on 25th September, 1952, and consists essentially of pulling a cable core into a long aluminium tube and then pulling both through a sinking die so that the sheath is brought close to the core.

So-called seamless tube is used, which in fact contains one or two weld lines due to metal flow round mandrel supports during extrusion. Certain difficulties arise concerning weak points, but tubes sufficient to cover cables of 250 yd long and upwards can be produced. The operation of sinking imposes cold plastic deformation on the tube. This cold working results in the sheath becoming harder and less ductile, but does not cause embrittlement.

Cable Characteristics

As a result of bending tests, it has been decided that the rates of sheath thickness to diameter should be not less than 0·05. Since this gives greater mechanical strength than is necessary from other considerations, bending performance alone may be said to decide the gauge of the sheath. When subject to severe bending tests aluminium sheaths, while not cracking, are more prone to corrugation and flattening than lead sheaths.

Tensile strength is sufficient to dispense with reinforcement in some oil-filled and gas-pressure cables. Creep strength is reckoned to give an adequate margin of safety



11 kV aluminium sheathed cable weighing 1·35 lb/yd suspended from catenary wire between telephone line poles on a desert route

at maximum working temperatures for cables operating under an internal pressure of 250 lb/sq in. Some allowance for thermal expansion is necessary, and at points remote from natural bends, this may be provided by deflecting 15 to 20 ft of the cable about 3 in. out of the route line, either horizontally or vertically.

Replacement of lead sheaths by aluminium sheaths has little effect on heat flow conditions within the cable, but the current carrying capacity is affected by the lower resistivity of the aluminium, which results in higher sheath losses. These become of some importance with single core cables. In short-circuit operation, the current ratings established for lead cables are applicable to aluminium sheathed cables, since in most cases lead-sheath conductivity is not a limiting factor.

Installation Practice and Experience

For most surface installations, the aluminium sheath is left bare, thus achieving a neat and attractive appearance combined with economy in cost. On the other hand, for all buried cables, protective coverings embodying a layer of water-impervious rubber-like material are now considered essential, as a result of earlier experience with fabric covers.

It is found that the work-hardened aluminium sheath will accept positive and negative strains of the order of 3% at maximum bends without visible corrugation. The effort needed to produce a bend, however, is more than twice that for an equivalent lead cable, and the use of tools is frequently advantageous. Difficulties arising with large cables in confined spaces or on routes containing a series of acute bends constitute an undeniable disadvantage.

In laying cables direct in the ground, the most satisfactory procedure is to take advantage of the light weight and tensile strength by pulling on the cable in order to pull the length off the drum and along the trench. In ducts, it has been found that the rigidity of the sheath does not interfere with installation.

DISCUSSION

MR G. F. PEIRSON (Midlands E.B.) considered the paper a fair appraisal of both the advantages and disadvantages of aluminium sheathed cables. He had used them in substations where their rigidity compared with lead permitted neater arrangements. When multicore cables, aluminium sheathed, had been used, there had been a saving of some 25% in the cost of the supporting structure, but this had been largely offset by the labour cost entailed by greater difficulty in bending them. In the Midlands Division, with long straight runs in power stations, the position was more favourable.

In the Midlands they had not used aluminium sheathed cables for street mains because they were concerned about maintaining good protection against corrosion. This would be difficult when the cable had to be cut frequently to take-off services. The real advantage of aluminium sheathing was seen when the mechanical properties were used as an intrinsic part of the design, as in gas pressure cables. In some circumstances the number of joints which resulted from relatively short lengths only being available offset other advantages. There was also a need to be sure that the protective covering had an adequately long life.

DR G. L. J. BAILEY (B.N.F.M.R.A.) discussed mechanical properties and corrosion resistance of the cables. He considered the picture very encouraging from the aspect of creep. So far as corrosion was concerned, he felt that copper in natural waters might have an effect as well as oxygen.

MR J. M. WARD (B.E.A. Research Lab.) recalled that work on overhead conductors had shown that with concentrated industrial atmospheres, serious corrosion could occur; however, the authors were dealing with a smooth surface, whereas that of overhead lines was effectively corrugated, and there was also an electrostatic attraction effect. B.E.A. work had suggested that dissolved copper might have some effect on corrosion. He was concerned about the life of protective coverings for aluminium sheaths.

MR F. W. ROGERS (Aluminium Development Association) thought that the next step should be aluminium sheathed cables with aluminium conductors. So far as corrosion when aluminium was in contact with a wall was concerned, spacer saddles seemed to be the best answer.

MR FORBES JACKSON (L.C.C.) said that the L.C.C. had found aluminium cables satisfactory and handling had given little trouble. However, now that lead was more readily available, a return had been made to lead sheathed cables, because there was little difference in price in non-armoured types. Some economic stimulus was needed to make industry use aluminium cables. Since it appeared to be the processing of aluminium that was costly, the need was for a continuous extrusion process. He was not unduly pessimistic about corrosion problems.

MR D. T. HOLLINGSWORTH (B.I.C.C.) agreed that aluminium cables would have to be sold on a basis of economic rather than technical advantage. Both tube sinking and welded designs required the use of semi-processed aluminium, which might cost £350/ton against £150 for ingot metal. His company had been working on direct extrusion, and after starting with a small double ram press had now developed a machine which could extrude sheaths up to 3½ in. diameter directly onto cable cores. The major features of the new press were rapid recharging of billets—the operation took a matter of seconds to achieve—and the maintaining of a vacuum above the metal during extrusion.

MR A. J. GOOD (Johnson and Phillips) discussed a mathematical theory of tube sinking.

MR G. A. RENDLE (B.I.C.C.) thought that it would cost 40% more to handle aluminium sheathed cables than the comparable lead sheathed designs. The future of aluminium sheathed cables lay in large diameters and long lengths. He agreed with the authors that serving should be carried well into the joint box when joints were made.

MR H. W. B. GARDINER (G.E.C.) speaking of welded and corrugated aluminium cable sheaths, stressed the advantages of being able to control the rigidity of the aluminium. For some purposes mechanical strength was not required, and it was advantageous to keep the sheathing soft. There was no limit on the length in which welded sheath cable could be supplied, other than that imposed by drum considerations.

MR J. H. GOSDEN (B.E.A.) stressed the importance of the protective covering. He suggested that the manufacturers should suggest what tools were required for the bending of aluminium sheathed cables. Referring to the possibility of using cathodic protection technique to prevent corrosion of the buried aluminium, he said that the use of this system for buried structures was increasing in this country.

MR P. ROBINSON thought that lead was the proper choice for cable sheaths for general purposes, and that unless price considerations made it necessary it would be a mistake to try to substitute aluminium

MR G. S. BUCKINGHAM (M.E.B.) emphasised the importance of keeping up to date with the techniques of handling aluminium: in the long run, he felt that more use would have to be made of it.

MR H. M. POWELL (Costain-John Brown) recommended that the idea of applying cathodic protection to aluminium should be treated with great reserve.

notes on wiring

by Megohm

I ALWAYS find the subject of cables extremely interesting, whether they be the common v.r.i. cables or any of the others in everyday use. In discussions on cables, their uses, their qualities, etc., one question always seems to crop up: the advantages and otherwise of the 660 V grade cables, which are favoured by certain people on installations where the voltage to earth is below 250.

Cable Grades

Many engineers use what we once called 660 V grade cables on the grounds of the increased insulation and mechanical strength. (The latest edition of B.S.7 distinguishes them as medium voltage heavy duty cables.) However, it is a well established fact that the more widely used 250 V grade cables have satisfactorily stood the test of time, and I have inspected and tested installations which were up to thirty-five years old, and found the cables in good condition. Apart from a hardening at the cable ends, the insulation was quite good. May I add that these installations were not subjected to any conditions which would expedite deterioration. On certain installations, however, the wiring had not been so carefully installed and I was rather amazed that the wiring stood the strain at all.

Double insulation is, of course, provided between phase and neutral where conductors are touching and single insulation to earth where the cables are in contact with earthed metal. The cable manufacturers test these cables at high voltage during manufacture, and a 500 V insulation test is normally applied by the electrician after installation. From this I believe that 250 V grade cable, used under normal conditions, is quite adequate on low and medium voltage installations. Please note, though, that I stress "under normal conditions." In certain cases, however, the use of 660 V grade cables is called for, but unless conditions are very bad, I feel that their use is not fully justified on general lighting circuits.

For 415 V t.p. power circuits the use of 660 V grade cables is argued by some to be good engineering but the fact remains that 250 V grade cable is still widely used for such circuits, without much evidence of trouble.

Cost

The increased insulation used for 660 V cables increases the cost of the cable. The increased insulation in turn means that a larger conduit must often be used. It is therefore rather a costly matter to use this grade of cable. I can well imagine the thoughts of the electrician who is given the job of connecting four 3/·036, 660 V grade cables to a 5 amp flush switch housed in the standard box. Apart from the difficulty of making a neat job of the cable ends, I can see a strain being imposed on the conductors at the switch terminals due to lack of space. The time factor must also be appreciated. Obviously with this grade of cable connections to switch-sockets, switches and so on must take longer. Isolating switches, switch-fuses and fuseboards are provided with larger connections than the usual accessories, but again I feel that the electrician may run into trouble due to lack of space. Certain makes of switchgear have little enough room for 250 V grade cable, as I have found out in the past.

The life of all cables can be lengthened by the sealing of the ends; that is the opinion of the experts in these matters. Perhaps one of these experts might estimate the increase in length of time for us. I should hesitate even to attempt this, for I have noticed no efforts to seal cable ends on the many installations I have seen. Certainly I have seen p.v.c. sleeves fitted to cable ends at switches etc. but these do not exclude the air from the rubber insulation at these points. I realise that it is hard to determine the "life" of a cable in years and equally difficult to determine "normal conditions." What is apparently a normal condition might in fact be the reverse and can be the result of the "human element" which we are always inclined to forget.

Bad handling of v.r.i. cables is the "something" which governs the life of the cable, whether it be the pulling-in of the cable or that bad habit of obtaining that extra half inch of tail at an outlet *after* the box lids are fitted. I can recall at least two installations where this caused excessive tightening of the cables in a junction box and which eventually caused a breakdown in the insulation.

Fuseboards

It appears that fuseboards fitted with miniature circuit-breakers in place of the normal fuses are becoming quite popular. I think that they are very useful and hope to see them used much more, especially in houses and installations where the ordinary fuse would be subject to repairs by all and sundry. It is almost proverbial that in such cases the repairs to the fuses have been carried out by means of hairpins and other such material. The fitting of m.c.b.s does overcome this problem and seems to me to be the answer to this evil of "handyman repairs."

I recently met a resident engineer who had solved another problem by fitting m.c.b.s in place of fuses. The problem came to light during last winter when certain 5 amp switch-sockets, in the rooms occupied by resident staff, caused faults on the installation. On investigation it was found that these sockets were badly damaged by the staff using 2 kW fires on them. The use of the fires was unauthorised and they were, of course, "non-existing" when enquiries were made. Anyhow, the fires were again in use following the repairs to the sockets but eventually the wiring broke down.

When the rewiring of the installation was carried out, the m.c.b.s were fitted in the fuseboard and the circuits rearranged to line up with the carrying capacity of the m.c.b.s. The result was that whenever a circuit was overloaded the m.c.b. cut out and the offender was left without the fire. Of course, the trouble could not be rectified until the offending apparatus was disconnected. I may add that the rooms in question were adequately heated by a central heating system and the switch-sockets were intended for radio and/or table lamps. I feel certain that many resident engineers will agree with me that the use of unauthorised apparatus is frequently a serious problem.

Holger Nielsen

A NEWLY ADOPTED METHOD OF ARTIFICIAL RESPIRATION

By E. J. Willott, F.I.C.A.P. (B.E.A. Ambulance Centre)

PUBLICITY is now being given to the Holger Nielsen type of artificial respiration, which has recently been introduced into this country. Statistics supplied by the United States and other countries suggest that the performance is really most encouraging, and it is hoped that a larger percentage of lives will be saved in Great Britain by this new method. Although we say this method is "new," it is so only as far as this country is concerned.

Let us see how this type of artificial respiration came into being. Over fifty years ago, the gymnastics instructor of a school near Copenhagen, Danish Lieutenant Holger Nielsen, was called home to find his child choking and unconscious. He accordingly performed Sylvester's method of artificial respiration, which was the only one he knew at the time. His child eventually recovered, and from then onwards he resolved to teach artificial respiration to as many persons as possible.

He was not satisfied with the position in Sylvester's method, nor by the fact that the operator should if possible have an assistant, and, after learning Schäfer's method, he started to experiment and with the assistance of specialists he evolved the method known as the "back pressure and arm lift," now known as the Holger Nielsen, which has been in use in Denmark for many years.

It was first adopted by the United States armed forces in 1951, and in the following year it was recognised as an official method by many organisations in this country.

Advantages

A few words about the method. For instance, what has the Holger Nielsen method got that the Schäfer and Sylvester have not? The answer is quite simple: it gives "100% better ventilation of the lungs," because it assists both inspiration and expiration, and, in addition, it is less tiring to the operator. It can be performed by only one operator for a good length of time.

Now for the position of the patient. This is very much akin to that for Schäfer's. The operator kneels on one knee at the head of the patient with the other foot at the elbow of the patient. To produce expiration, pressure is applied to the shoulder blades with the thumbs on the spine, and the chest is compressed against the ground. Inspiration is produced by the weight being taken off the chest and the bent elbows being slightly pulled back and up. (Appropriate pressures are shown below.) This whole operation, which should be rhythmic in character, should be repeated between nine and twelve times per minute until the patient recovers or death is pronounced by a member of the medical profession.

APPROPRIATE PRESSURES FOR ARTIFICIAL RESPIRATION

24-30 lb for an average adult.
12-14 lb for a slight person.
2-4 lb for an infant.

A wall-chart giving illustrated instructions for applying the Holger Nielsen system of artificial respiration and suitable for display in accordance with Regulation 29 of the Electricity (Factories Act) Special Regulations, may be obtained from the offices of the "Electrical Times," price 2s. 6d., plus postage.

Should a second operator be available, it may be advantageous to combine the Schäfer with the Holger Nielsen method, i.e., the Schäfer expiratory movement is performed, and as the operator relaxes, the Holger Neilsen

First position: put hands on patient's shoulder blades, thumbs on spine

Second position: rock forward, compressing chest against ground

Third position : slide hands to patient's elbows

Fourth position : pull bent elbows backwards and upwards

operator does the inspiratory movement by raising the patient's elbows.

It is suggested that the "pressures" be tried out on a weighing machine with the platform about twelve inches from the level of the ground. It should never be assumed that "the more pressure the better the treatment." This is absolutely incorrect, as considerable damage may be caused by not applying the correct amount of pressure.

Always remember that, whilst the Holger Nielsen is an extremely good method, practice should be continued with both the Schäfer and Sylvester methods, as it is not always practicable to use the Holger Nielsen. For instance, the arms and shoulders may be fractured and, therefore, one would have to revert to Schäfer, or the patient may be trapped in a face upwards position and could not be turned over and, therefore, the Sylvester method would have to be used.

In conclusion, it may be noted that medical opinion is that the Holger Nielsen method is especially valuable in cases of electric shock.

Acknowledgment is given to Dr P. Pringle for his advice in the preparation of this article.

Investigating the Ionosphere

OPENING the 45th Kelvin Lecture at the I.E.E. last week, Mr J. A. Ratcliffe, O.B.E., M.A., F.R.S., pointed out that it was nearly 30 years ago that reflection of radio waves from the ionosphere was first demonstrated. The discovery initiated investigation of the ionosphere from two points of view—the engineering aspect which was directed at finding out more about radio wave propagation and improvements in radio-communiations and the purely physical aspect in which the upper atmosphere as a whole was studied. Mr Ratcliffe was concerned in his address with the latter point of view, stating that despite the previous 30 years of investigation, the study of the physics of the upper atmosphere was still in its early stages. To prove his statement he chose but three of the present lines along which investigations are proceeding and based his lecture on a description of these three approaches.

The first attack directed at the two layers, designated E and F, of ionised atmosphere which lay at 100 and 250 kilometres above the earth's surface, involved transmitting a short train of radio waves at the ionosphere and measuring the time taken for the echoes of the waves to return to earth. Assuming that the radio wave travelled with the same velocity as that in free space, the time interval between the start of the wave and the first echo was a measure of the distance travelled by the wave and therefore of the height of the reflecting layer. It was found that the lower (E) layer was responsible for reflecting the lower frequency waves whilst the upper (F) layer reflected higher frequency waves. By varying the frequency of transmission it was found that a maximum or critical frequency existed beyond which reflections did not occur. This frequency gave a measure of the maximum electron density of the layer, showing that the F layer was not only deeper but had a higher electron density than the E layer.

During the war, the necessity of maintaining continuous radio communications resulted in the setting up of a series of ionosphere observatories from which the ionosphere could be continually studied. By 1945 extensive data on the maximum electron densities of the two layers had been accumulated from which it became apparent that there was considerable divergencies in the behaviour of the two layers. Ultra-violet light falling on the layers was the cause of their ionisation and therefore as the seasons, days, sunspots and other variables affected the quantity of u.v. light falling on the layers so the maximum electron densities would be expected to vary in sympathy. Whereas the E layer behaved as anticipated, the F layer did practically everything which was not expected.

This led to the suggestion that the maximum electron density might vary because the shape of the layer altered. Further investigation had then led to the derivation of the shape of the layer from the curves of effective height plotted against frequency.

A second avenue of study lay in an investigation of small-scale variations of the ionosphere. Its reflecting surface was far from specular (likened to a piece of white cardboard as opposed to a mirror). This led to the postulation that ionosphere built up a diffraction pattern on the ground as a result of its being irradiated and hence by studying the reflected wave it was possible to determine the surface which produced it. By recording the outputs from three receivers on the ground it was possible to obtain not only the picture of the wave variations but the speed at which they moved along the ground. Somewhat like radio noise in appearance, it could be analysed by the aid of auto-correlation function and, if possible, by Fourier transforms. The pattern and movement of the ionosphere deduced from such analyses gave ground for believing in the existence of seasonal ionospheric "winds," but the rotating component of the movement was possibly linked with tides, thermal and electro-magnetic effects.

Atmospheric Whistles

In the third approach to the study, investigators were studying the outermost parts of the ionosphere by observing the diffraction occurring in radio waves when they travelled through the atmosphere. The study introduced the audience to perhaps the most fascinating demonstration of an evening far from mundane—a recording of the phenomenon of "whistling atmospherics." Such recordings were made from an audio-frequency amplifier which, at its input end, was connected to nothing more than a large aerial.

It was known that a lightning flash gave rise to a considerable radiation of electromagnetic waves of frequencies in the audio range. Such waves would penetrate the ionosphere and, in its outer edge, be constrained to move along the earth's magnetic lines of force. In travelling through the ionosphere, however, they are dispersed by the ionisation (as a ray of light is dispersed in a prism) and when the wave was directed back again to the earth, the higher frequencies arrived first, giving rise to the whistle. On hitting the earth's surface, the wave was reflected back along its path to the other side of the earth and back, suffering greater dispersion and hence giving rise to a longer whistle. Successive reflections thus resulted in a series of whistles, each longer than its immediate predecessor, but slightly diminished in volume until finally they disappeared. In making the journey waves reach a distance of some three earth's radii from the earth. Hence, a study of the intervals between successive whistles, and the degree of dispersion provided a measure of the electron density at this distance.

A vote of thanks to Mr Ratcliffe, proposed by Mr T. G. N. Haldane, M.A., and seconded by Mr T. E. Goldup, was carried by prolonged acclamation.

TRANSDUCTOR CIRCUITRY

I.E.E. Measurement section paper discusses characteristics and design of single-phase push-pull transductors of the auto-self-excited type

LAST week's meeting of the I.E.E. Measurements Section was devoted solely to transductors. Two papers were read, of which that dealing with auto-self-excited transductors and push-pull circuit theory, by Mr A. G. Milnes, M.SC., A.M.I.E.E., and T. S. Law, B.SC., provided a comprehensive account of this type of magnetic amplifier, particularly in its use in circuits which are sensitive to both the sign and magnitude of the input signal.

Auto-self-excited transductors differ from conventional magnetic amplifiers in having single wave rectifiers connected in series with main windings. Thus the main current in each main winding in the pair of amplifying units is unidirectional, giving a circuit of high sensitivity. As the rectifier causes periods in which the mains current is zero, the flux level in the element core during these periods is controlled solely by the d.c. signal in the control circuit. The magnetisation characteristic of the core thus determines the flux for a given control current, the level of which, in turn, determines the instant at which the element goes into saturation and so influences the output voltage of the main winding. If the core permeability is high the control current is low, with a consequent high sensitivity.

Where transductors are without these auto-self-excitation rectifiers, the control current is required to be considerably larger as it must contain a component to balance the m.m.f. of the main circuit flux in addition to its small magnetising current determining the core flux. With this type of transductor, external positive feedback, known as self-excitation, is usually provided to improve its sensitivity but the effects of separate self-excitation may be reproduced by the presence of auto-self-excitation rectifiers. Moreover, in the separately excited magnetic amplifier, zero core m.m.f. is obtained only as a resultant of two opposed m.m.f.s which introduce high copper loss. In fact, the auto-self-excited circuit may have a copper loss only 4/9 of that of the separately excited type.

Simplified Theory of Operation

Although considerable information is available on the operation and development of auto-self-excited transductors, a simplified account of their action may be made on the basis of several assumptions, thus facilitating their study for design work and applications. Principally, there are three types of single-phase auto-self-excited transductor connection, the basic unit being the simple parallel connection. With this method, the load current is alternating, being the difference of the two element currents. Secondly comes the bridge connection employing four rectifying elements, two of which provide auto-self-excitation and the other two route the larger of the element currents through the load. The third arrangement employs a centre tapped supply transformer, the functions of auto-self-excitation and load current rectification being performed in two rectifier valves only. In this arrangement, the load current is the sum of the two element groups. Apart from these two connections having d.c. outputs, their modes of action differ only slightly from that of the straightforward parallel connections but they have the advantage of higher output voltages.

Although it is assumed that the rectifiers have infinite reverse resistance, in practice a reverse leakage current exists, its effect being to lower the sensitivity of the transductor connection as the m.m.f. of the leakage current must be balanced by an additional control circuit m.m.f. The leakage current, however, is kept low provided the reverse voltage is low and a value of 10 V has been recommended for this voltage. In this respect the parallel connected arrangement has certain advantages.

The paper derives a theoretical sensitivity for auto-self-excited transductors which shows that the current amplification factor of the parallel connection is simply related to the ratio of transductor reactance to total circuit resistance. If the elements are re-arranged as a series transductor the current amplification is unchanged provided the total circuit resistances are equal. Morover, all three connections of the basic circuit have identical theoretical sensitivities, but in practice they differ slightly as a result of second order effects. For design considerations, practical auto-self-excited transductor characteristics are closely similar in shape to the desaturation limb of the core B/H loop, from full positive to negative saturation. Such a relationship provides means of designing transductor circuits which give reasonably accurate results and realistic shapes for predicted characteristics.

Although the presence of inductance in an a.c. load changes the transductor current and voltage waveforms, and associated theoretical characteristics, the general magnitude of transductor sensitivity is not greatly altered. Generally, the presence of inductance introduces curvature into the theoretical characteristic but in practice the effect tends to be masked by greater non-linearity in the core materials. In a rectifier fed transductor, inductance smooths the load current but again, both mode of action and sensitivity of the transductor thus arranged differ by no great amount from those of the parallel connected transductor.

It has been mentioned previously that the current amplification factor of an auto-self-excited transductor is a constant established by the ratio of transductor resistance and reactance, but gain variation may be obtained by the introduction of negative or positive feedback, known as boost excitation. The main circuit current may be rectified and fed back through windings on each element, the ratio of boost turns to main turns being quite small. Although an expression can be obtained for the gain under such conditions, in some cases the number of feedback turns may only be adjusted on test.

Push-Pull Transductors

When a duo-directional output from a magnetic amplifier is required, the most common method in use utilises push-pull transductor pairs. Such an arrangement holds a distinct advantage in that each transductor in a pair reacts almost identically to variations of bias current or supply voltage and frequency giving a high zero stability. In terms of input power, a zero stability of 10^{-9} watts is readily achieved whilst constant supply conditions and environment can result in a stability of 10^{-11} watts. As the properties of push-pull transductor pairs have, until recently, received somewhat less study than single phase

devices, considerable attention is paid to them using the same simplifications and assumptions as used earlier.

Several types of push-pull output circuits are discussed, the elementary form being a parallel connected pair with tee-summation of their outputs to give an a.c. output which reverses in phase with direction of input signal. Another circuit gives tee-summation through a transformer output which enables the output load to be matched to the transformer pair. For d.c. outputs, several arrangements are possible, one of the simplest being that of magnetic summing which employs push-pull coils on the load apparatus. Where a single-load reversible d.c. output is required, series-resistor and tee-resistor summing arrangements are most commonly used.

Magnetic Load Summing Circuits

Of the common d.c. push-pull output circuits, magnetic load summing into twin load coils is seen to be preferable on the ground of efficiency. Care, however, must be taken to ensure that mutual coupling between the coils, which results in interaction between the transductors and consequent unsatisfactory push-pull operation, is minimised. Capacitance smoothing across each load coil usually removes most of such coupling. For the series-summing push-pull connection, the transductor operating voltage may be considerably greater than its rated value. With full voltage up-rating the output characteristic is similar in sensitivity and current swing to that of the magnetic summing arrangement, but this result is achieved only at the expense of a substantial increase in the input power to the amplifier.

Composite Transductor Cores

The second paper at this meeting described the development of a composite core for use in instrument transductors. Presented by E. H. Frost-Smith, B.A., PH.D., A.M.I.E.E., and A. E. de Barr, B.SC., F.INST.P., the paper is concerned primarily with self-excited transductors. Without self-excitation a transductor m.m.f. gain is almost independent of core properties, but that for a transductor with 100% self-excitation is shown to be determined by the core reluctance. Ideally a core material with constant and high permeability up to saturation is required. In practice, the best silicon-iron alloys, although relatively cheap and having a high saturation flux density, possess a lower permeability and a less pronounced "knee" than high permeability nickel-iron alloys. These, however, are not only more expensive but saturate at lower flux densities, although their all-round magnetic properties at low frequencies are better suited to transductor requirements.

By suitable choice of the area and length of different magnetic materials, however, it is possible to build up a composite transductor core which approaches the magnetic ideal and yet is economically reasonable. On this basis a core may be considered as built up from a short bridge section of material 1 and a U-shaped yoke of materials 2*a*, 2*b*, 2*c*, etc., in parallel. Material 1 should be a material particularly suitable for transductor cores, such as nickel-iron and the yoke from a grain-orientated silicon-iron alloy. Providing the ratio of cross-sectional areas of yoke and bridge are correct, when the bridge becomes saturated, the flux density in the yoke can correspond to a point of maximum permeability. At low flux densities, the high initial permeability of the bridge means that the total reluctance of the core is essentially that of the yoke.

DISCUSSION

MR A. C. LYNCH (P.O. Research Station) referred to the difficulty of defining the requirements of the material used for the cores of transductors, and suggested that there was general agreement that the main requirements were high permeability, sharpness of saturation, and reasonably low cost. The real difficulty, however, was to know what compromise should be made if the ideal material was not available. It was not just initial permeability for which they were looking; it was probably something more like, though not exactly, the maximum permeability. Both sets of authors asked for linearity of the characteristic, and the difficulty there was that there was no obvious reason why the characteristic should be linear. It might be better to look for a material of extremely high slope, to which some negative feedback could then be applied.

DR R. WILLHEIM (Consulting Engineer), dealing first with the paper by Frost-Smith and de Barr, said the authors would probably agree that the initial permeability—the initial bend—had little or no meaning for an ordinary transductor, and so should have little place in a figure of merit. That had some bearing on a point raised by Mr Lynch. They were not so much interested in a perfectly linear B/H loop as in one in which the centre part remained perfectly linear. The authors referred to some potential advantages, mainly economic, from the use of composite cores, which were in the first instance concerned with single-ended transductors. For push-pull transductors the case was slightly different because even if the individual transfer curves of the component transductors were non-linear the resultant push-pull curves would be perfectly linear.

MR S. E. TWEEDY (Ultra Electric) said that Milnes and Law considered optimum circuit proportions and, while he agreed that the ratios proposed were suitable for a general purpose amplifier, he felt that considerable scope existed for wide departure from them in cases where it was desired to improve particular properties at the expense of others of less importance. The graphical load-line method and that employed by the authors were complementary and lent a great deal of support to each other. The authors' method threw a useful light on the mechanism and the waveforms, while the graphical method was much easier to visualise and manipulate.

MR H. E. WICKS (N.P.L.) agreed with Frost-Smith and de Barr that the cost of nickel, while it might have lost its significance at the moment, would become very important in the event of another war. It was disappointing to find, however, that the authors' technique did not appear to be applicable to toroidal cores. If these transductors were going to be used in large quantities, the question of using toroidal cores would be important. Milnes and Law assumed throughout their paper that there was always a d.c. input, but the Admiralty had used a circuit in which, by reversing the direction of two of the main winding coils, an a.c. input could be used, which materially increased the impedance of the input circuit without affecting very much the gain or the time constant.

MR J. W. MCPHERSON supported the technique recommended by Milnes and Law of using the non-dimensionalised transductor characteristic, which from experience he had found could provide a very rapid solution to design problems. Frost-Smith and de Barr laid their main emphasis on the saving in cost achieved by using composite cores, but he doubted whether this saving could exceed 10%.

DR E. H. FROST-SMITH (Elliott Bros.), commenting on the paper by Milnes and Law, said that the number of transductor circuits had been increasing as the years went by, and it was time that something was done to classify them into definite types. The authors had perhaps not sufficiently emphasised the similarity between the auto-excited and the self-excited transductor. The auto-self-excited type used less copper and had therefore lower losses. In view of this, was there any future for the self-excited transductor, and if so, where?

DR ULRIK KRABBE, of Copenhagen, in a written communication, pointed out that the time constant of the transductor was dependent on all the control windings, and since the main winding, with the self-saturation rectifiers in series, made a closed circuit, it would also contribute to the time-lag. The influence was dependent on the fraction of time when both the self-aturation rectifiers were open and there was no reverse voltage across any of the rectifiers. To study this it was necessary to take into consideration the voltage drop in the main winding from the small excitation current, and it appeared that the reverse voltage angle was dependent on the resistance of the control winding and he felt that the influence on the time constant of the main winding was small.

DR FROST-SMITH and MR MILNES briefly replied.

E.R.A. constructs a Multi-purpose Network Analyser

ONE of the features of the network analyser being constructed by the Electrical Research Association at their Greenford Laboratories is that it is capable of investigating network frequency response, a facility not hitherto incorporated, as far as is known, in conventional analysers. When the E.R.A. planned to construct a network analyser to be available to the industry for both routine and research problems, provision was made to use the network elements in three ways. The first two provide for the study of networks under steady state and transient conditions and the third, as already mentioned, for frequency response investigation. However, facilities in the analyser are designed to supplement rather than duplicate equipment already commercially available and hence emphasis in its design has been high accuracy and wide range commensurate with cost. In fact, the equipment so far built was demonstrated to have an absolute accuracy of within 1% and a relative accuracy of 0·1%.

In all, provision is made for eight wings of racks housing network elements, four interconnecting units or plugboards and two central measuring and control desks, for steady state transient studies respectively. A single wing and temporary plugboard was put into service in 1951 in conjunction with commercial transient generating equipment but this has now been supplemented by a second wing of racks, a full-sized plugboard, three steady state generators and their associated control desk. At the demonstration last week, it was to this new equipment involving a number of interesting techniques, that primary emphasis was given.

Main Components

Basically, in common with most types of network analyser, the equipment is arranged in four main parts for steady state studies. Firstly are the passive and active network elements which are connected together in the second item, the interconnecting board, to represent the system under investigation. An illuminated indicating board, over which is superimposed a manufactured pattern of the system being studied, provides a direct means of ensuring correct interconnection. Third in the arrangement is a selection and control system from which any point in the network may be selected for measurement by the measuring system, the last part of the broad scheme.

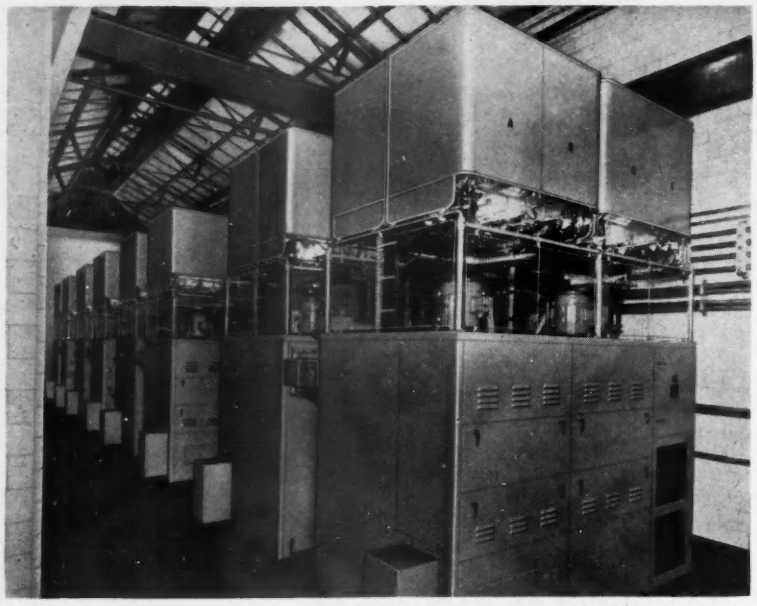
As cost was a prime consideration in the work, the base parameters of impedance of 100 ohms (10 millihenrys and 1 microfarad) and a power of 2·5 milliwatts (500 milliwatts and 5 milliamps) enabled standard telecommunications components and equipment to be employed and moreover the low power values assisted in keeping down the bulk of the equipment. Passive network elements comprise two, three or four-terminal networks arranged compactly on small chassis units mounted on the racks. Decade impedances or simple series or parallel connections are used for two terminal elements, whose terminals are brought out and identified by coloured leads at the plug board. Three or four-terminal elements are treated for convenience as pairs of two-terminal networks.

Measuring System

The steady state generators are of conventional design and are in fact amplifiers of adjustable phase and amplitude. A supply is taken from the three-phase master oscillator, whose base frequency is 1·592 kc/s ($\omega = 10^4$ rad/sec) and frequency range 0·159 to 15·92 kc/s, converted to single phase and fed through a system of phase shifters and amplitude potentiometers to an output amplifier of output impedance 0·3 ohms. For voltage and current measurements a servo-system bridge technique is used, the current measurement being made across a shunt in the flexible cord connection of each element. The bridge system is entirely automatic, the measured voltage being compared in a transformer to a voltage obtained from servo-controlled reference phase shifter and potentiometer which are fed from the master three-phase supply. The error voltage is injected into the high gain servo-amplifier which automatically adjusts both controls to give a zero error voltage.

Right, shows a general view of the analyser, the steady-state control desk shown in the foreground and master oscillator unit on the right

Bond Street Substation Re-equipped



Static rectifiers and new switchgear installed

THE "Central Line" of London Transport's underground system was opened as far back as 1900, and many of the original rotary convertors are still running. Moreover, since 1928 they have been operating at a speed one-third higher than their design speed due to the changeover in high-voltage supply from 25 to 33⅓ c/s.

With the projected change in supply to 50 c/s and taking into consideration the age and wear of the rotaries, it was regarded as essential to re-equip some of the older substations as a matter of high priority, and at the same time to install modern static conversion plant arranged for remote supervisory control.

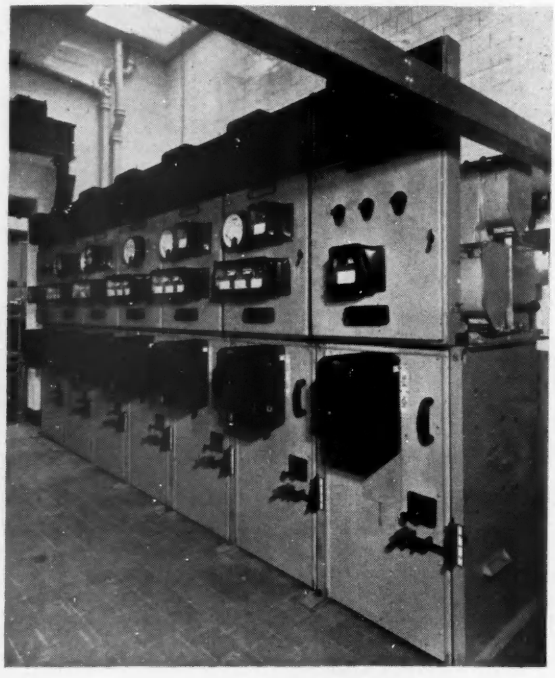
First of these substations on the Central Line was that at Bond Street. As a first requirement two new 11 kV cables were laid from Notting Hill Gate to replace the existing 5·5 kV supply. The complete changeover of the substation was undertaken by the Hackbridge and Hewittic Electric Co., in close collaboration with London Transport's chief electrical engineer. The operation was programmed to be carried out in two main stages, the first consisting of the replacement of the original rotary convertors by an equal number of Hewittic mercury vapour rectifiers, and the second the re-equipment of the switchgear section, involving the installation of a bank of 11 kV oil circuit-breakers, two d.c. switchboards (one embodying the latest truck-type high-speed circuit-breakers and control panels on the positive busbar and the other, with drawable contactors and panels on the negative side), auxiliary transformers and switchgear for lighting and signalling supplies, etc., and finally the supervisory control gear. The first main stage was successfully brought to its conclusion in September of last year.

Rectifiers

Owing to the restricted floor space, the rectifiers and their associated transformers are combined into one unit, the individual parts being arranged in sections to permit of their being manoeuvred in a small space by only two or three men.

Each 1,000 kW rectifier is made up of two self-contained 500 kW units, and occupies about the same floor space as was taken up by each rotary convertor. By mounting the rectifier bulbs and their ancilliary equipment on top of the transformers, the usual interconnecting cabling has been avoided and sufficient additional space obtained to permit installation of the new d.c. switchgear and the gear required for the supervisory control scheme.

On the left is a view of the machine room of the old station, and above the same machine room after rectifiers were installed; below is a view of the 11kV switchgear



Supply is taken from London Transport's 11 kV system through dry-type air-cooled transformers, 3/6 phase, to give a 630 V output for the rectifiers. The phase angles of each pair of transformer primaries are displaced, one 15° forward, and one 15° backward, thus resulting in effective 12-phase operation of each 1,000 kW set.

Six 3-anode rectifier bulbs are employed on each unit, and these are mounted in two triangular groups, each cooled by a single fan. The exciter unit, anode fuses and anode chokes are contained in a separate compartment alongside the main transformer.

Reconstruction

To maintain the required output of the substation during reconstruction it was necessary to install new equipment prior to the removal of the old. Advantage was taken of the existence of some land outside the substation to build a small annex to house temporary high tension a.c. switchgear. The convertors were housed in a long narrow section of the building with restricted crane height. As a first move, therefore, one-half of a 1,000 kW unit was erected between Nos. 1 and 2 rotary units. This was followed by the removal of the No. 1 rotary machine transformer which permitted the erection of the second half of the rectifier unit. To cover the transitional period, however, the capacity of these units was increased by the addition of two bulbs to each unit and this provided a sufficient margin of power to cover demands during peak periods. The removal of the first convertor was then carried out.

The difficulty of dismantling the remaining machines was facilitated by the unique constructional characteristics of the rectifiers, the top sections of which were dismantled as required to permit the passage of armatures and yokes. It was at first thought that this would need to be carried out during the nightly shut-down, but by effecting preliminary dismantling of rotaries, and with accurate planning and timing of operations, it was found possible to perform the work during the morning off-peak periods.

The commissioning of the rectifiers was initially necessary on a 33⅓ c/s supply, but their design is such that the only changes required when 50 c/s is introduced will be replacement of the fan motors and adjustment of exciter and anode chokes.

One d.c. circuit-breaker controls each 1,000 kW unit, and until the d.c. switchboard controlling the rotary convertors could be dismantled, each rectifier breaker was placed alongside its appropriate rectifier equipment. With the removal from service of the last rotary convertor, the second main stage of the operation was begun, when the obsolete d.c. switchboard was removed and space made available for the installation of the new d.c. switchgear in its permanent position.

Switchgear

The d.c. positive breakers of the high-speed truck type are arranged in a bank of ten with a bus-coupler contactor positioned in the centre. These control the four rectifiers, four track feeders and two escalator feeders. The negative contactors are also of truck type, and are arranged to open immediately following the tripping of their positive counterpart. On the high-tension side, duplicate busbars and seven 11 kV, 350 MVA oil circuit-breakers are installed. Each rectifier circuit-breaker is interlocked electrically with the corresponding d.c. breaker so that in the event of an internal fault the rectifier equipment is completely isolated. The whole of the switchgear is designed for operation by remote supervisory control which has not yet been installed, although a centralised control panel is present in the substation and this gives all indications and alarms. At present such operations as starting and stopping of the rectifiers and the closing and tripping of breakers will be carried out by local control.

The modernising of this substation also included complete replacement of the d.c. cables feeding the railway tracks and escalator circuits. These have been installed on an entirely new run via one of the disused lift shafts, which has permitted ample segregation of the cables and ready access. There is a vertical drop of 80 ft, between the upper and lower levels, and all the cables, both low tension and high tension are of the non-bleeding type, paper insulated and pre-impregnated with Diatrine compound. They were manufactured by W. T. Glover and Co., and installed by London Transport staff.

COLOUR TELEVISION

A MOST interesting paper dealing with the problems and future potentialities of colour television was presented last night by Commander C. G. Mayer (the European Technical Representative of the Radio Corporation of America) to the Royal Society of Arts. He was naturally more concerned with the present state of development in the United States, where the twelve channels in Bands I and III allocated to television were already in full use. The pressure for television channels however, required the extension of work into Bands IV and V and some 70 new channels had now been provided. There were now 250 stations operating in Bands I and II and an additional 130 stations in Bands IV and V. A further 220 total constructional permits had been granted in both bands and 275 applications for new stations were pending. The congestion in the radio spectrum had become so intense that the Federal Communications Commission had taken the view that it would not be feasible to provide any extra bandwidth for colour. Thus it was necessary to compress the full information required for colour into the same bandwidth as was used for ordinary black and white television.

Research on this problem had shown that the signal requirements could be met by providing ½ mc/s for transmitting three colours (green, red and blue) or ½ Mc/s for a two colour system (orange and cyan) and in addition about 4 Mc/s was needed for the picture detail information.

In order to transmit this information over the restricted channel, recourse had to be made to systems of multiplexing and Commander Mayer went into considerable detail as to how this could be done. He concluded that the utilisation of the 6 Mc/s channel could be best utilised by a full 4 Mc/s television bandwidth signal representing luminance varieties of the subject and transmitted as amplitude modulation of the picture carrier. In addition there would be a suppressed sub-carrier located within the band at a frequency determined by "frequency interlace," and this would be simultaneously modulated by two chrominance components, one with about 1½ Mc/s bandwidth representing saturation varying the amplitude of the sub-carrier, and the other 90° out of phase with the first representing live varying the phase of the sub-carrier.

A complete signal specification for colour television broadcasting had been recommended to the Federal Communications Commission by petitions submitted by R.C.A. in June 1953 and shortly afterward by the National Television System Committee representing the radio industry. At present, colour programmes were being radiated by the N.B.C. station in New York several times a week, and colour receivers are in production at the rate of several thousands a month. They cost about £350 to the purchaser. Radio relay circuits have been equalised for colour and are in regular use.

Research for Development

Change in emphasis called for at E.R.A. Annual Luncheon

WHETHER the vast sums of money being spent by industry on research were being used in the best way, was queried on Friday by Viscount Waverley, in a speech at the annual luncheon of the Electrical Research Association. He suggested that in many cases, fundamental research was being carried rather wastefully beyond the likely limits of effective results. It was questionable, he thought, whether we had the technologists to match and balance the scientists who were concerned with fundamental research, and he suggested that for individual firms at any rate, a change of emphasis was justified. He called, in particular, for greater support for research associations, and said that a slight increase in what was spent on the E.R.A. by the industry could be of considerable assistance.

Dealing with firms who wished to conduct research themselves, and keep the results private, Lord Waverley said their attitude was short sighted. In the export field especially, it was the prestige of an industry as a whole that counted.

All who were concerned with the electrical industry, he went on, would be thrilled with recent developments. He recalled that in 1947 he had expressed the hope that some way would be found of harnessing the power in thermo-nuclear reactions for peaceful purposes, and he still felt that some advance in this kind of atomic furnace might come about.

New Laboratories

Sir Lawrence Bragg, the new President of the E.R.A., replied to Lord Waverley's toast to the Association, and in his speech stated that the E.R.A. had now secured promises totalling £195,000 towards the £200,000 which was a prerequisite to a D.S.I.R. capital grant towards new laboratories at Leatherhead. He went on to discuss the place of the research association in providing a link between the scientist and the industrialist. He characterised the former as achieving his purpose if he had one success out of many attempts. This was very different from the attitude of the men of action who had to conduct industry. He was followed by Mr C. T. Melling, Chairman of the E.R.A. Council, who proposed Professor Bragg's health. In the course of his speech, he said that industry could not today afford to wait scores of years, as it had done in the past, between some fundamental discovery, and its successful industrial application.

Annual Report

The Annual Report of the E.R.A. which was published in time for the annual meeting was the 33rd, and surveys the calendar year 1953. As always, it reviews research projects covering the whole range of electrical engineering, as well as a number of other activities.

The main effort in researches concerning generation remains on the subject of high temperature alloy steels, and it is planned in 1954 to greatly increase the work on creep properties. An investigation on cracks in molybdenum steel steampipes has been completed. An aspect of work with condensers which is receiving special attention concerns corrosion when tubes are used with polluted waters. This is proving a serious problem for some power stations.

Circuit-breaker work is being accorded the usual close attention, and the work in hand ranges from basic investigations into the mechanism of arc interruption to detailed studies of the aerodynamics of the air-blast circuit-breaker. A new subject on which work has been initiated is that of the pressures set up in side-blast baffle-pot type breakers at high powers.

Work on a design of arc-chute for use in air-break arc-chute type a.c. circuit-breakers has been extended, and during the year experiments at Perivale have been supplemented by a research programme conducted at a short-circuit testing station. On the associated subject of contactors, much attention has been given to determining the relative importance of the large number of variables involved in making comparative tests. Effects studied include the effect on contact velocity of the instant the magnetic circuit is made, and the effect of contact force, phase rotation and current on contact wear. Fuse studies have extended to the problem of the heating of multi-way enclosed fuse units, and an investigation of the ratio between prospective current and arc energy has been continued.

Cable Ratings

On the cable side, attention is being given to the behaviour of cables in ducts. Further consideration is being given to the thermal values of soil used in assessing the rating of cables, as a review of the previous work has indicated the need for extension in certain directions. In the work on short-circuit effects, attention has been concentrated on the behaviour of joints.

Work has been started on a comprehensive revision of the E.R.A. standard ratings for paper insulated cables. It is planned to take account of recent developments in permissible operating temperatures, operation of cables in ducts, cyclic loading and the thermal properties of soils. Ultimately, reference will be made to short-circuit ratings.

So far as transformers are concerned, some important results have been obtained concerning short-circuit stresses. A study is now being made of the forces in multi-layer windings. This section of the Association has also been concerned with capacitors from two aspects. The first relates to the problem of protecting series capacitors when a line fault occurs, and large scale tests of a proposed method using a spark gap and an air-break air-chute type circuit-breaker have been made. The other capacitor subject is the measurement of high voltages by capacitor transformers.

The investigation of the effect of lightning on transmission lines has continued, and thirteen co-operating area boards supplied some four thousand lightning fault reports during the year. Damage due to lightning has been studied, and special attention has been given to cases where damage has occurred at substations connected through underground cables to overhead lines. In connection with the impulse breakdown of insulation, experiments have been made to determine the effect of such items as conductor size and shape, and paper thickness in cables.

As always, there has been much activity in the investigation of all aspects of dielectrics, and fundamental work has been supported at a number of universities. Notable

investigations in the immediately practical field have included field trials on inhibited transformer oils, and the study of "greening" of cotton covered copper wire.

Installations

During the year, ratings have been determined for a variety of small cables suitable for use in installations, so that rating tables may be elaborated if costs may be reduced by taking account in more detail of construction and environment. Work has also been carried out to determine the rating of 660 V cables used in air for 400 c/s supplies. This work has been undertaken at the request of the I.E.E. to meet the increasing industrial use of supplies at frequencies above 50 c/s.

Attention has continued to be given to earthing problems, and during the year work was almost completed on information to be submitted to the I.E.E. Code of Practice Committee. Discussion have been held with the I.E.E. to clarify the position on earth continuity values and measurements, with a view to amending the Wiring Rules in accordance with the latest information on the impedance of earth continuity conductors.

Fires of electrical origin reported during the years 1951 and 1952 have been analysed with a view to correlating their incidence with age of installation, and the work is being extended to cover a third year.

On the appliance side, particular interest relates to a dual purpose heat pump which came into prominence during the year. A larder, fitted with a freezing compartment and other kinds of evaporator has been installed, and tests being carried out with it include a ¼ h.p. hermetic refrigeration unit immersed in a 30 gallon domestic hot water cylinder. Because of heavy public demand for information on this aspect of the heat pump, several tests are being run simultaneously.

The characteristics of various chemicals which change state at low and medium temperatures has been studied with a view to incorporating them in a portable storage heater. Some success has been achieved, and a heater of this type should prove economical both as regards cost and weight when compared with other storage media.

Work in the rural section has included the testing of alternative designs of cable for use with an electric tractor. Another project involves portable electric weed killers. Experimental plots of bracken have been treated electrically, though whether with full success is as yet uncertain. Another electrical killing method which appears promising is the use of high frequency electric fields for the destruction of pests in stored grain and other materials. Higher frequencies are now to be tried.

Miscellaneous Researches

Much progress has been made during the year in diminishing the corrosion of the oxygen element in fuel cells. Arrangements have been made to build further hydrogen-oxygen cells, so that the operation of two or more cells in series may be studied.

New work in the "unclassified" section is planned to include an investigation of tooth ripple losses in alternators, and of the elimination of the static charges acquired by textile materials in passing over rollers. The former research is to be carried out at King's College, London, under the direction of Professor Greig.

POWER OF THE FUTURE

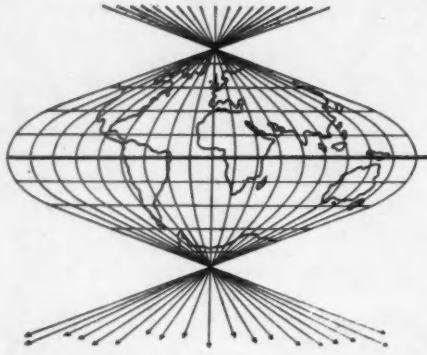
SPEAKING at the Institute of Fuel's Annual Luncheon last week, Sir Christopher Hinton, F.R.S., commented on the use of atomic energy as a fuel.

He said that "fuel" generally implied the use of chemical reaction to produce useful heat. In atomic energy this was produced by atomic re-arrangement. There was nothing more wonderful in atomic changes than there was in chemical changes, but in conventional burning it was easy to start the reaction, whereas in using atomic energy it was difficult. Nevertheless, we were simply dealing with fuel, and in this field atomic energy had tremendous advantages. There was every reason that we should be most interested in alternative fuels from those in conventional use. On the best estimates of easily-mined coal resources, it was unlikely that they would last more than 200 years. Hydro-carbons should be more than heat, as they were a most important source of raw materials.

The problems of atomic energy were considerable, but those problems had to be measured in the light of present knowledge. It was doubtful if they were greater, in proportion, than those which confronted the early developers of steam engines. Progress in the atomic energy field was necessarily slow, but results were now arising from the work undertaken in the last 7—8 years. For example, in connection with the chemical process of the separation of plutonium and fission products, extremely difficult problems had to be attacked. The work was most complex because the plant, once established, could not be approached, and some parts could never be approached for examination. The cost of this type of plant was about £2 millions but with the experience developed in the past few years in design and construction, we could now deal with such equipment, and this type of work was now regarded as routine.

The prospects for atomic energy were promising. The Cumberland piles would soon be producing power for the Grid, but this was only the first step. It should nevertheless be possible to produce power at about 1d. per unit, a price about 50% more expensive than in an efficient Grid power station; but this included capital charges which were very large and was in itself an encouraging factor, as capital cost would fall as techniques became better understood and more advanced. It was probable that the cost of coal in terms of real values would tend to rise and in 10 or 15 years, probably, he thought in 10, we should be building nuclear power stations comparing in cost with conventional power stations. To make the best progress towards this object, industry must be drawn in increasingly. It had already played a great part in design studies and part construction, in collaboration with the Ministry of Supply, of component parts. But selected firms would have to take a much more fundamental interest in atomic power station work. The Atomic Energy Organisation was not for the design and operation of plant of established types, but for ensuring future progress. It was hoped that the B.E.A. would build atomic energy plants in conjunction with industrial firms. We were prepared to train them initially, but they would have to go on on their own.

Prior to Sir Christopher's speech, Dr W. Idris Jones presented the Melchett Medal to Dr H. H. Storch, of the U.S. Bureau of Mines.



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Newfoundland Survey

A hydro power survey is now being conducted in Newfoundland and Labrador by the British-Newfoundland Corporation, which was formed last year, Mr J. Smallwood, the Newfoundland Premier, has stated. Engineers from the Montreal Engineering Co., and the Shawinigan Engineering Co. are studying the watershed of the 350 mile long Hamilton River and the Grand Falls, which are twice as high as Niagara Falls. It is estimated that the Falls could provide 4 million h.p. and the river a further 10 million h.p. Both are to be fully investigated to see if the water power could be utilised in the speedy development of the ore regions of Labrador. Newfoundland's northern domain has ten main rivers of which the Hamilton is the largest. It rises in a plateau 1,800 ft above sea-level. It is estimated that the river at the Grand Falls drops 760 ft within twelve miles, with a water movement of 5,000 cu ft/sec.

Getting Toronto Running Again

Units Nos. 3 and 4 at the Richard L. Hearn generating station of the Hydro-Electric Power Commission of Ontario, which were not directly involved in the explosions last month, are now expected to be back in operation late this summer, possibly in August, we understand. It seems that units Nos. 1 and 2 will not be running again for at least 18 months. Although representatives of the Commission, of C. A. Parsons and Co. and insurance agents are carrying out a full investigation into the cause of the explosion, Mr R. H. Saunders, chairman of the Commission has made a guarded admission that mechanical failures and not a hydrogen gas explosion was responsible. Parts from two of the sets are now at the maker's works in this country for a complete check.

B.C. Joint Developments

A meeting was held recently in Victoria, British Columbia, between representatives of the North Western States of the U.S.A. and of British Columbia, to endeavour to map out joint power developments, principally involving the Columbia and Fraser rivers. A committee reported that there had been a definite interest in developing 45 new hydro-electric projects in the Province and the U.S.; having an aggregate capacity of 8,359,000 kW. We have already referred to the plan to erect nine dams on the Columbia River basin in the East Kootenay area One dam, at Mica Creek, will be 600 ft high, to store 10 million acre-ft of water, capable of producing 800,000 h.p.

EUROPE

Railways in Germany

Agreement in principle has been reached between the Bundesbahn and the Government of Land Hesse in the German Federal Republic, on the method of financing schemes for electrifying important sections of the Federal railway system in Land Hesse. The sections of line involved run between Darmstadt and Mainz/Bischofsheim and between Frankfurt and Mannheim/Friedenfeld. The Darmstadt/Mainz line is of particular concern to the Bundesbahn authorities since it forms an important part in the latter's plans for electrifying a north-south railway link between the Ruhr and Southern Germany and Switzerland. It is proposed that the cost of the schemes estimated at DM 200 millions, should be met from a 20-year loan from Land Hesse to the Federal railways.

Spain's Floating Plant

One of the floating power stations built in the U.S.A. during the last war is now being put to further use by Spain. The ship is an old destroyer in which two 4,500 kW steam turbines made by the General Electric of America have been installed. The boilers are oil-fired. The floating power station has seen service in many parts of the world, and a few days ago was towed by tug to the Spanish naval base at Cartagena. The station has been acquired by the National Institute of Industry, a Government concern, and is on loan to Spain's National Electricity Board, to whose power system it is connected, to augment the local supply particularly to the Cartagena mining region.

Transmission Line

The Greek Public Power Corporation is shortly to consider tenders for the construction of the main transmission line between the Agra hydro-electric plant in West Macedonia, about 65 miles north-west of Salonika, to Larissa in Central Greece, a distance of around 80 miles. The Agra plant, of 60 MW capacity, has been constructed by the Italian Societe Edison Co.

S.W. ASIA

Rural Electrification Needed

Criticism has been levelled at the Madya Pradesh Electricity Board for not pushing rural electrification. It has been alleged that the villagers' long-standing demand for electricity for agricultural purposes has not yet been fufilled while preference has been given to towns and large industries. In the State Legislature members suggested that an experiment might be made in community development plans to see how electricity could be utilised for raising agricultural production and developing small-scale industries in villages.

Bombay's Problem

During a discussion on the power shortage in Bombay in the State Legislative Assembly recently, it was said that in the past three years there had been 930 applications for power involving a total load of 10,034 kW, but at the present time no industrial loads, other than for night time only, were being sanctioned. During the same period Tata Hydro-Electric Agencies had refused 104 applications involving undiversified load of 48,316 kW. It seems evident that there will be no easement of the situation until three new generators are installed at the Chola power station.

Additional Finance

Canada is providing $20 millions of the $31 millions necessary for India to construct the Mayurakshi hydro-electric and irrigation project in West Bengal, it is announced. The Indian proposal that more Canadian aid be allocated to the project has been approved. Canadian aid was provided under the Colombo plan for economic assistance to underdeveloped countries. Scheduled for completion next year, the project is expected to irrigate an average of 120,000 acres in the dry season.

MALAYA

Connaught Bridge Extension

Most of the civil engineering work for the second stage of the Connaught Bridge power station of the Central Electricity Board, Malaya, has now been completed. The foundations for the four boilers and two turbo-alternators have been prepared and some of this plant has recently arrived at Port Swettenham. The first stage, comprising two Parsons 20 MW turbo-alternators and four Babcock and Wilcox 120 klb/hr boilers were put into commission early last year. The aim is to have the first set of the extension in operation towards the end of this year, and the completion of the station with four machines by the end of 1955. Incidentally, the Board also have plans for the construction of a 30 MW steam station at Malacca.

AUSTRALIA

Expansion at Port Augusta

The Port Augusta power station of the Electricity Trust of South Australia is to become the largest station in the state. The Trust has decided to call tenders for the supply of three 60,000 kW turbo-alternators and five 360 klb/hr outdoor type boilers for the "B" power station to be erected adjoining the "A" station on the artificial island site at Curlew Point, four miles from Port Augusta. The "A" station, where the first set is expected to be in operation this winter, will have a capacity of 90,000 kW.

Brighter Hopes in Victoria

Work is to be speeded up on the Kiewa hydro-electric project, Victoria, Australia—that assurance was given by Mr Galbally, the State Minister for Electrical Undertakings, recently when he performed the ceremony of firing the final charge to complete a new tunnel which will feed water from the East Kiewa River to No. 4 power station. Four 15,400 kW generators are to be installed in that station, and the first machine is expected to be in operation by November next. Mr R. A. Hunt, chairman of the State Electricity Commission, said that the demand for power in Victoria was increasing so rapidly that the Government must take a hand in helping to finance development projects. Mr Galbally then gave the assurance that there would be increased activity on the Bogong High Plains in the spring, for if Victoria was to go on being a great state it must have power in abundance.

Another Snowy Contract

The contract for the construction of the T.I. underground power station in the Snowy Mountains hydro-electric scheme, Australia, has been placed with a group of French firms. Construction of the station involves excavation 300 ft long, 60 ft wide and 80 ft high, some 1,100 ft below the surface of the ground. Value of the contract is £A3,894,000, which is £A754,000 below the Hydro-Electric Authority's estimate. The French firms concerned are: Compagnie Industrielle de Travaux, Entreprise Fougerolle pour Travaux Publics, Societe Generale d'Entreprises, Etudes et Entreprises, l'Entreprise Industrielle and Societe Nationale de Travaux Publics.

This station will house four 80 MW machines, orders for two of which were noted in our 15 Apr. issue.

S.A. Railways

There are suggestions that the plan for the electrification of Adelaide's suburban railways may be shelved by the South Australian Government until further experience has been gained in the economics of diesel traction operation. The main reason for the suggestion, apparently, is that the price of fuel is falling and Australia will soon be producing oil in large quantities herself. The State Cabinet has already approved the calling of tenders for the supply of a further six diesel-electric locomotives to bring the total to 16. The total cost of conversion to electric running was estimated in 1949 to be nearly £4m, of which the Commonwealth would pay 70% under the railways standardisation agreement. Electrification proposals were for the conversion of the Adelaide hills line as far as Belair, the Brighton-Marino line at present being duplicated, the main north line as far as Dry Creek, the Henley-Grange line and Port Adelaide line as far as Outer Harbour. About 53 miles of railway would be involved.

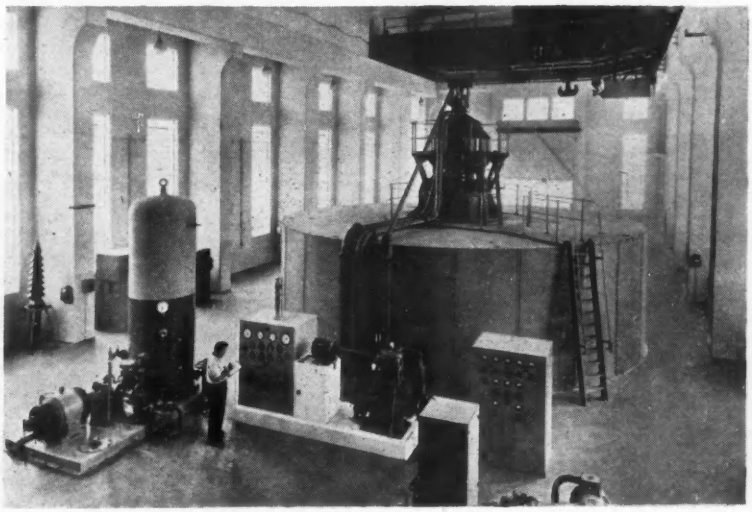
NEW ZEALAND

Hopes in North Island

In spite of an expected increase of 18 to 20% in electricity consumption in the Auckland, New Zealand, area this winter, no power shortage was expected there or in any other part of the North Island, Mr C. J. Lovegrove, president of the N.Z. Power Supply Authorities Association stated in Christchurch recently. He said the phenomenal increase in consumption expected this year represented the dammed-up demand resulting from years of power shortage.

Future Plans

The development of hydro-electric power stations at Huka Falls and Aratiata Rapids on the Waikato River, was referred to as "a very long way off in the future" by Mr Goosman, New Zealand State Minister of Works, earlier this month. He said that, although tests had been made at the sites which are of considerable beauty and among the better known of New Zealand's tourist attractions, the building of power stations there would mainly depend on the rate of progress made at other sites along the Waikato and on the development of geothermal steam power supplies. There was a big programme ahead in building stations at Whakamaru, Waipapa, Atiamuri and Ohakuri and no work was at present scheduled at Huka Falls or Aratiatia Rapids. When Whakamaru, Waipapa, Atiamuri and Ohakuri were developed, they would probably turn to the East Coast, where engineers were now investigating the potential of the Kaituna River as a source of power.



In the South Island, New Zealand, the Tekapo hydro-electric scheme is nearing its completion with the final touches being added to the new 200 ft long and 40 ft high retention dam to hold the waters of the lake. The station has one 25,000 kW English Electric vertical water turbine driven alternator, which has been operating for some time now. The turbine operates under a gross head of from 80 ft to 105 ft and develops 30,000 h.p. and 35,000 h.p. respectively under those heads, running at 150 r.p.m. To give good efficiency over the wide range of operating head, the turbine is of the propeller type having a runner with feathering blades, which are actuated by specially designed gear. The Tekapo project forms part of the extensive water power development of the Waitaki River undertaken by the N.Z. State Hydro Electric Department

Personalities IN THE INDUSTRY

Newman Industries Ltd. announce the appointment of **Mr W. D. Wilson,** M.I.PROD.E., to the board of directors. He joined the company in 1935 as works manager. Prior to that he was with Crompton Parkinson Ltd. for twelve years and with Bruce Peebles and Co., Ltd., for six years. He will continue in his present executive capacity as general manager of the company's Grantham works.

On Thursday of last week, **Mr W. M. Tribute**, export advertising manager of Hoover Ltd., completed 35 years' service with that company—the first member of the staff to do so.

Mr Miles Beevor, managing director of the Brush group, left London by air last weekend to visit Ceylon, Singapore, Australia and Canada.

E. K. Cole Ltd. announce that **Mr. W. S. Porteous,** who has been associated with the radio and television activities of the company for a number of years, has been appointed car radio sales representative for Scotland.

Dr D. W. R. McKinley has been appointed to the new position of assistant director, division of radio and electrical engineering, National Research Council of Canada.

Col B. H. Leeson, T.D., C.B.E., M.I.E.E., was re-elected chairman of the Association of Short-Circuit Testing Authorities at the Association's annual general meeting last week.

Mr R. L. Higgin, A.M.I.E.E., has been appointed sales manager to "Diamond H" Switches Ltd., in succession to **Mr F. A. Honess,** who is now the company's production manager. Mr Higgin was apprenticed with the Walsall Electrical Co., Ltd., and later joined the British Electrical and Allied Industries Research Association. He served during the war in the R.N.V.R. as electrical lieutenant and was subsequently Northern Counties technical sales representative to "Diamond H" Switches Ltd., prior to his new appointment.

Mr Henry S. Wingate, vice-president and a director, has been elected president of the International Nickel Co. of Canada Ltd. He has also been elected to membership on the Executive Committee of the company and to the presidency of its United States subsidiary, the International Nickel Co., Inc.

Mr D. A. Thomson, B.SC., has been appointed to the board of the Belmos Co., Ltd. An honours graduate of Glasgow University, he joined the company in 1947 after service in the army, in which he held the rank of major.

Mr J. R. Fulford has been appointed a director of Marco Refrigerators Ltd.

Previously contracts manager, **Mr C. B. Griffiths** has been appointed sales manager of Pyrotenax Ltd.

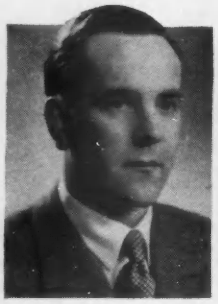
Just appointed sales manager to Cimex-Fraser Tuson Ltd., is **Mr Edmond F. Johnson,** who will be responsible for the company's sales organisation at home and overseas. For the past seven years he has been a buyer with J. A. Ewing and Co., Ltd.

The Metropolitan-Vickers Electrical Co., Ltd., has appointed **Mr A. J. Budd,** B.SC.TECH., as assistant superintendent, Leonard Works. Mr Budd took his degree at Manchester and went to Metropolitan-Vickers as a college apprentice in 1943, subsequently joining the staff of the Motor Engineering Department as a junior engineer. Later he transferred to the manufacturing side of the department, and in 1949 he was appointed development engineer. He has been assistant supt. Motor Dept., since Oct. 1951.

Mr W. Matthews, A.M.INST.C.E., civil engineer to the East Midlands Division of the B.E.A., is relinquishing that post this week-end to take up a similar appointment with the North Staffordshire area of the West Midlands Division of the National Coal Board.

A new appointment, that of chief engineer to their Communications Division, has been announced by Marconi's Wireless Telegraph Co., Ltd. This post is to be held by **Mr C. Gillam,** who will now be working in close conjunction with **Mr A. W. Cole,** A.M.I.E.E., the manager of the Division. Mr Gillam first joined the Company in 1930 and after some years with the Transmitter Test Section, spent four years in Turkey installing and maintaining high power broadcasting transmitters. Returning to England in 1942, he became chief of the Aerial Design and Systems Planning Group on its formation in 1948 in which capacity he was responsible for the designs of aerials and associated equipment. His work for Marconi's has taken Mr Gillam to many European countries, to Egypt and to South Africa. Mr A. W. Cole first joined the Marconi Company in 1924, transferring to Imperial and International Communications Co., Ltd. (later Cable and Wireless Ltd.) in 1930. He rejoined the Marconi Company in 1948 as manager, Communications Division. He has had a lifelong experience in the communication field.

We offer our congratulations to **Lt-Col C. H. Blackburn,** managing director of C. H. Blackburn and Co., Ltd., and of E. Dawson (Lamp Factors) Ltd., who has been honoured by appointment as Aide-de-Camp to Her Majesty the Queen. Col Blackburn commands an R.A.O.C. reserve unit in the Army Emergency Reserve and the appointment signifies the importance attached to the A.E.R.



Mr R. L. Higgin

Mr C. B. Griffiths

Mr E. F. Johnson

Mr A. J. Budd

Lt-Col C. H. Blackburn

Mr H. W. Bowen

Mr S. C. T. Cox

Mr B. D. Jenkins

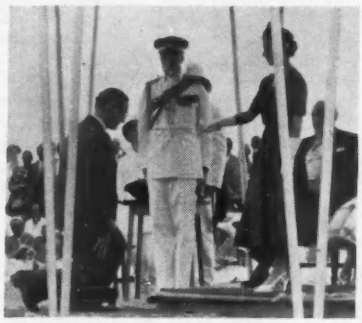
Mr E. F. Alldritt

Mr L. A. H. Twyford

Three new appointments have been made to the staff of Gresham Transformers Ltd. **Mr S. C. T. Cox,** A.M.I.E.E., who has joined the company after 22 years with Foster Transformers Ltd., is to represent the company in the industrial field. Mr Cox was educated at Kingston Grammar School and Wimbledon Technical College. **Mr B. D. Jenkins,** B.SC., A.M.I.E.E., who has joined the design staff of Gresham after representing the company in respect of power distribution transformers, earlier served with South Wales Switchgear Ltd., after graduating at University College, Cardiff. The third appointment is that of **Mr E. F. Alldritt** as publicity manager of Gresham Transformers Ltd. He previously held a similar post with E. R. and F. Turner Ltd., and Bull Motors, and was earlier assistant publicity manager with the Kelvin-Hughes group of companies.

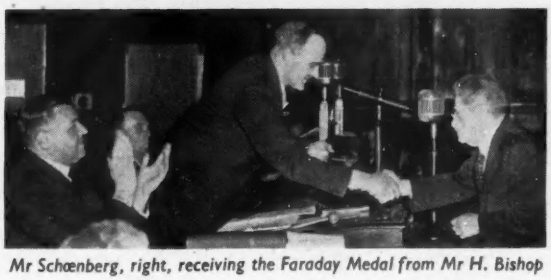
Mr H. W. Bowen, O.B.E., M.I.MECH.E., M.I.P.E., has been appointed technical director to H. J. Baldwin and Co., Ltd., and consulting engineer to the Baldwin group of companies. He has had a wide and distinguished career on the production side of engineering. He was for four years on production work with Ford Motor Co., and seven years an executive with Vickers Armstrong. He was associated with E.M.I. for 13 years, primarily as production manager and eventually for five years as managing director of E.M.I. Factories Ltd., resigning from that position in 1952 to join Britannic Electric Cable and Construction Co., Ltd., as managing director, a post he relinquished at the end of March last. Mr Bowen is also a director of Air Trainers Ltd., Clark Matthew Ltd., and chairman of High Pressure Components Ltd. He is a member of the Council and a past-president of the London section of the Institution of Production Engineers.

Mr A. S. Mansell, sales manager of R. and A. G. Crossland Ltd., has been elected a director.


Sir Charles Westlake, chairman of the Uganda Electricity Board, being Knighted by H. M. the Queen at Jinja last week

Professor of Electrical Engineering at Nottingham University, **Prof H. Cotton,** M.B.E., D.SC., M.I.E.E., is to retire at the end of August, we hear. He joined the staff of Nottingham University College in 1919, following war service. Prof Cotton graduated at Manchester University and then gained experience in various parts of the country. He also lectured at technical colleges in Huddersfield and St. Helens, but the name of Prof Cotton will be more familiar to many in connection with the numerous textbooks of which he is the author, such as "Electrical Technology," "Applied Electricity" and "Alternating Current Machines." Prof Cotton proposes to live in retirement at St. Ives, Cornwall, we understand.

At last Thursday's meeting of the Institution of Electrical Engineers the Faraday medal was awarded to **Mr Isaac Schoenberg** for his outstanding contributions to the development of television, more particularly in this country, and the formal certificate of honorary membership of the Institution was presented to **Mr Ernest Leete** in recognition of his outstanding services to the I.E.E. We earlier referred to these awards in our 14 Jan. issue.


Mr Schœnberg, right, receiving the Faraday Medal from Mr H. Bishop

Mr L. A. H. Twyford, who was recently appointed assistant export manager of E. K. Cole Ltd., is now on a business tour of the Far East. Before taking up his new appointment Mr Twyford was with the British Victor Division of E. K. Cole Ltd.

Mr J. J. Gowen, A.M.I.E.E., who recently retired after 25 years' service with the Electricity Supply Board, Eire, has been presented with a silver tray and a decanter set of cut glass by the staff at Kilbarry, Co. Cork.

At the recent annual meeting of the British Electrical and Allied Industries Research Association, **Sir Lawrence Bragg,** O.B.E., M.C., M.A., F.R.S., was elected president for the ensuing year.

Among more than 500 delegates and visitors to the 29th E.A.W. Annual Conference at Torquay from May 17 to 20 will be two visitors from the Netherlands. They are **Miss B. J. Bellaar Spruyt,** LL.B., secretary of the Dutch E.A.W., and **Mrs H. J. Mansholt,** wife of the Netherlands Minister of Agriculture. Miss Bellaar Spruyt is well-known to E.A.W. members to whom she brought greetings from the 30 branches of the Dutch Association at the E.A.W. Annual Conference at Southport in 1948.

OBITUARY

Mr R. H. Blackburn, formerly chief engineering assistant to the city engineer of Nottingham, died on 26 Apr., aged 70. He had been associated with the construction and extension of the North Wilford power station over many years, and with other civil construction work for the former city electricity undertaking.

Mr Norman Marsh, one of Canada's leading authorities on international waterways, died on 20 April, aged 63. For many years he was a member and honorary secretary of the Canadian Committee of the World Power Conference.

Mr R. L. Hought, who was until his retirement a director of T. Beadle and Co., Ltd., for a number of years, died on 28 April.

Mr A. B. Crowsley, a director of Battery Services (Kettering) Ltd., has died, aged 74.

Prof H. S. Allen, D.SC., LL.D., F.R.S., who was Emeritus Professor of Natural Philosophy in the University of St. Andrews from 1923 to 1944, died on 27 April, aged 80.

Equipment for Industry

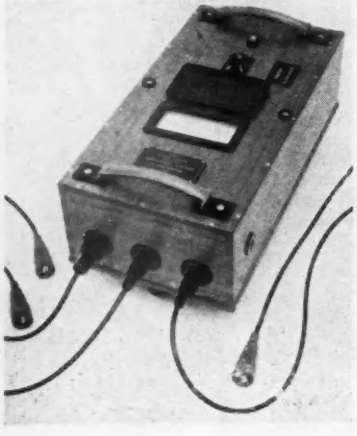
A 10 kV "Megger" Insulation Tester

MORE recent requirements of insulation testing require tests to be made over periods ranging from a few minutes to over half an hour with the result that such tests fall outside the scope of the normal hand driven insulation test. To meet such cases, EVERSHED AND VIGNOLES LTD., Acton Lane Works, Chiswick, W.4, have now produced a mains operated "Megger" insulation tester which provides a d.c. supply of 10,000 V. In common with other testers in the "Megger" range, this instrument is of the true ohmmeter type, giving direct indication of the value of insulation being measured.

In this instrument, the d.c. generator has been replaced by a static rectifier power unit energised from a standard single-phase supply. The moving system is mounted on synthetic jewels, being of the same pivoted, cross coil construction of that of hand-operated instruments. Housed in the base of the movement main frame is a small mains-driven vibrator which gives the power output necessary for the instrument's operation. This would normally be provided by the generator. The complete unit is housed in a case of seasoned teak having dimensions of 23 in. by 12 in. by 10½ in. height, and weighing some 54 lb. Two scales are provided on the dial, the outer ranging from 60 to 20,000 megohms and infinity, the inner from zero to 1,000 megohms. Adjacent to the scale is located the range switch from which the desired scale is selected, whilst a red pilot lamp on the top of the case indicates that the instrument is in operation.

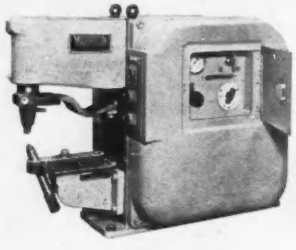
In one end of the case are mounted the plug sockets of the line guard and earth terminals. Together with every part of the deflecting circuit, the line terminal is fully guarded to eliminate surface leakage effects, but at pressures of 10 kV "brush discharge" may also cause large errors. To prevent such discharge, all live metal in the deflecting circuit is enclosed in insulating metal. For the same reason plug socket type terminals are fitted, test leads fitted with suitable plugs being supplied. The guarding system is also brought out to a terminal for connection to the part under test should surface leakage be likely. To prevent circuits under test retaining a static charge, the instrument is also fitted with an automatic discharge resistance which is connected between line and earth terminals on disconnecting the mains supply.

Evershed & Vignoles' 10 kV mains-operated "Megger" insulation tester

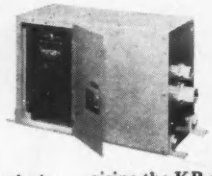


Metrovick's Bench Spot Welder

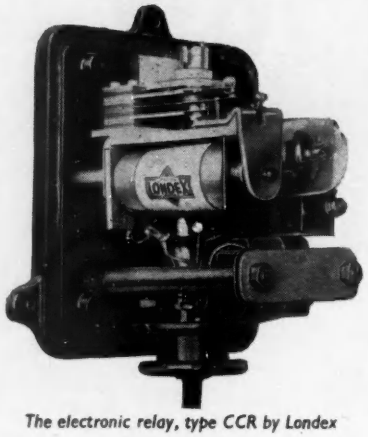
IN the sheet metal industry, where many components to be welded are small and of thin sheet steel, a small, high speed, air-operated machine is frequently required. Eminently suited for this type of work is the AS 10/9 spot welding machine, of 10 kVA loading, and 9 in. throat depth, introduced recently by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester 17. For mild steel parts, it is capable of welding clean metal up to two pieces of 18 s.w.g. on production and 16 s.w.g. intermittently. Stainless steel of up to 22 s.w.g. is stated to be also welded on this machine.



The "Metrovick" bench mounting spot welder and associated neon timer



For operation, depressing a foot switch initiates the welding cycle, single spot or stick welding being obtained respectively by momentary or continuous closure of the switch. The welding period is controlled by a neon timer operating in conjunction with a mechanical contactor, all equipment being housed in a separate steel case which can be bench or wall mounted. In the illustration, the standard straight bottom arm is shown, but an alternative round bottom arm may also be supplied. By fitting a top platen and combined bottom arm and platen, it is possible to convert the machine into a projection welder suitable for assemblies in the thinner gauges of mild steel.



The electronic relay, type CCR by Londex

Industrial Electronic Relay

TO increase the switching capacity of delicate contacts such as might be fitted on an indicating instrument to actuate an alarm circuit, LONDEX LTD., Anerley Works, S.E.20, are now manufacturing an electronic relay. Known as the type CCR, it uses no filament valves, incorporating a gas filled, cold cathode triode as a triggering relay, to operate a type KR post office type relay fitted with single pole change-over output contacts of switching capacity 2 amps at 250 V a.c. Housed in a dustproof, cast aluminium case, the relay requires a standard single-phase a.c. supply, which is fed into a small isolating transformer. Both supply voltage and output connections are made through a six-pole plug to socket whilst the "triggering" circuit is made through a co-axial plug and socket connection.

When the trigger circuit is completed, the cold cathode valve strikes, energising the KR relay connected in its anode circuit. On breaking the trigger circuit, the valve emission is extinguished thus de-energising the relay. As the trigger circuit is of high input impedance, a co-axial cable is required of length not greater than 15 ft. Such is the sensitivity of the relay that the valve is stated to strike when the input circuit is completed through a resistance of 2 megohms, in which circumstances the input current is reduced to 0·03 milliamps. Should the input circuit be completely short-circuited, the maximum current is limited to 0·1 milliamps, thus ensuring that no contact arcing or burning can occur. Possible applications for the relay include connecting to mercury in glass contact thermometers, the small value of current ensuring that no deterioration of the mercury can take place. It may also be used as a level control for liquids.

MK Cooker Units in White

CHANGING trends in kitchen decoration have brought about an increasing demand for cooker control units finished in white instead of cream. White units blend more easily with contemporary kitchen colour schemes and tend to match more readily the finishes of kitchen appliances. Therefore MK ELECTRIC LTD., Wakefield St, Edmonton, London, N.18, have decided to make available their cooker control units in white enamel finishes as an alternative to other finishes. List prices of the white units will be the same as for standard cream. First deliveries will take place early in June.

A New G.E.C. Transistor

A NEW introduction by the GENERAL ELECTRIC CO. LTD., Magnet House, Kingsway, W.C.2, is a germanium transistor, the GET2, which is available for home constructors as well as for equipment manufacturers. The new transistor is a low voltage operation version of the GET1 (still available only to equipment manufacturers) and will provide home constructors with a readily obtainable transistor for experimental work.

The Elga display unit

The connections, dimensions and operating precautions which apply to the GET1 transistor also apply to the new GET2. The ratings and characteristics of the two types are different, however. Since low voltage operation is the special feature of the GET2, the knee of the curve is important, and this is checked at I_c=5·5 mA, I_e = 3·0 mA, instead of at I_c=2·0 mA, I_e=1·0 mA, as with the GET1. The collector current at I_e=0 is measured at 10 V instead of 30. To ensure good gain the minimum limit for alpha is 2·5 instead of 2·0. Maximum collector voltage, V_c, is −30 V; the maximum collector current, I_c, is 15 mA d.c.; the maximum operating temperature, Top, is 35°C, and the maximum collector dissipation, p_c, is 75 mW.

Characteristics of the GET2 are as follows:

I_c when V_c = −10V	1·25 mA	max.
„ I_e = 0	·75 mA	typical.
V_c when I_c=5·5 mA	1·8 V	max.
„ I_e=3 mA	1·2 V	typical
I_{gain} „ V_c = −10V	2·5 mA	min.
„ I_e = 0−1 mA	3·8 mA	typical.
r_b (base resistance)	55Ω	typical

All transistors are tested to ensure stability under emitter short circuit conditions up to a maximum collector voltage of −25 V.

The new transistors are listed at 37s. 6d. each, but the price to equipment makers is only 21s. net.

An Auto-Perc Display Unit

A THREE dimensional display unit incorporating two "Auto-Perc" china bodies mounted on a laminated plastic baseboard is now available from ELGA PRODUCTS LTD., Railway Pl, Wimbledon, S.W.19, for loan to all Elga dealers.

TRADE PUBLICATIONS

MOTORS.—List No. 18 T.M. published by ELECTRO DYNAMIC CONSTRUCTION CO., LTD., St. Mary Cray, Kent, surveys the company's range of battery traction motors.

ELECTRIC VEHICLES.—Brush Electric vehicles of the Pony and Cob types are surveyed in a new list C.526 issued by BRUSH COACHWORK LTD., Loughborough, Leicester.

CONTROL CIRCUITS.—"Centralised supervisory control," (D/RC26) "Germanium junction, Photo-electric cells and Power rectifiers" (F/G1) and the 74701–A acoustic dual-feed controller are the titles of three new publications by STANDARD TELEPHONES AND CABLES LTD., Connaught House, Aldwych, W.C.2.

TRANSMISSION LINES.—Particulars of EETEE fuse links manufactured for immersion in oil are contained in pamphlet ETFS 20 issued by ELECTRIC TRANSMISSION LTD., Etruria, Stoke-on-Trent, Staffs.

ELECTRICAL EQUIPMENT.—Leaflet referring to the A11, R700, series relays, a booklet listing Reyrolle accessories and Reylovolt low voltage transformers and a new maintenance handbook on control gear have now been issued by DONOVAN ELECTRICAL CO., LTD., 70-82 Granville St, Birmingham 1.

WATER HEATING.—Amusing sketches accompany the sound advice on the selection and use of water heaters given in Publication W.H. 2020 Creda leaflet published by SIMPLEX ELECTRIC CO. LTD., Broadwell, Oldbury, Birmingham.

ACCESSORIES.—FALK STADELMANN AND CO., LTD., 91 Farringdon Rd, E.C.1, have just issued a new electrical accessories and control unit catalogue (802/54).

SOLDERS.—Second edition of "Modern Solders" booklet published by MULTICORE SOLDERS LTD, Maylands Ave, Hemel Hempstead, Herts, is larger and contains much up-to-date technical information.

DISTRIBUTION SYSTEMS.—Overhead fittings for copper lines are described in catalogue BH 110 published by BOWTHORPE ELECTRIC CO., LTD., Tinsley Lane, Crawley, Sussex.

CONDENSERS, ETC.—T.C.C. Technical Bulletins Nos. 44 and 45 published by TELEGRAPH CONDENSER CO., LTD., North Acton, W.3, feature Hi-K ceramic disc condensers and Hi-K miniature lead-through and stand-off ceramic condensers.

For the Electrical Trade

Therm-Accurate Hot Shelves

FINDING favour in the catering trade is a new pattern hot plate unit which embodies a patent non-wire element employing an application of carbon on asbestos as the heating medium.

These Therm-Accurate hot shelf units are available in standard units 34½ in. by 12 in. at £4. 14s. 6d. and 17in. by 12 in. pro rata. The elements are totally enclosed in aluminium casings dentated on one side to prevent unsightly scratching. Loaded at 275 W the shelf units speedily reach a temperature of 200°F and thereafter remain at that temperature. The heat spreads evenly over the metal surface leaving no hot spots or cold spots.

The great advantage of these units is their flexibility of usage; they can be used as small counter hot plates or can be built into storage cupboards or service shelves, and can easily and quickly be dismantled and reassembled for cleaning or redesign of the installation.

Extremely light yet strong and rigid, the heaters are almost break-proof. They are available for standard a.c./d.c. voltages 200/250 V whilst special sizes and voltages are made to order.

Therm-Accurate shelves are marketed by INFERATION LTD., 11 Old Bond Street, W.1, whilst sales enquiries should be directed to Dennis O. C. Littler, 54 Ormsby Lodge, The Avenue, W.4.

Therm-Accurate shelves can be used in a variety of ways

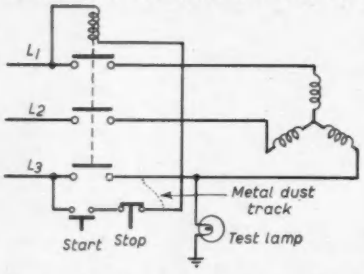
PROBLEMS AND PRACTICE

In Engineering

Dirty Starter

I WAS recently called to an electro-plating works to remove a 3-phase, squirrel cage induction motor, on a polishing spindle, and renew the bearing. As the fuses were in rather an inaccessible position and there was no isolator in the circuit, it was decided to rely on the direct-on-line contactor-type starter to make the motor terminal block dead, and proceed with disconnecting the motor.

Whilst doing this the spanner used happened to touch the frame and motor terminal at the same time and to my surprise the contactor coil became energised, accompanied by a flash at the terminal block, and the polisher motor started up. A test lamp was then connected from earth to terminals A, B and C of the starter in turn and in each case



Position of conducting track causing operation of the starter when the test lamp was applied

the motor started up. This suggested an earth fault of some kind but a "Megger" was not available to test the insulation resistance and a visual inspection of the starter showed no obvious fault. The starter was then thoroughly brushed out to remove any metal dust and on testing again with a lamp everything appeared to be in order.

The only solution that comes to the writer's mind is that metal dust must have collected sufficiently in the starter to cause a short circuit between the contactor coil circuit and terminal "C" of the starter, shown diagrammatically above.

This would allow the starter to operate correctly under normal circumstances, and means that when checked with a test lamp the contactor coil, although designed to operate on line voltage, was "pulling in" on the phase voltage.—*P. K. S.*

"Live" Water

THE fault recently described in these columns under the above heading could, a little more accurately, have been featured as "'Live' Water-filled Pipe." The writer can recall two peculiar episodes in which the water itself was quite properly stigmatised.

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

In the first, slight shocks were felt from the water leaving the "cold" taps in the bathroom, but not from the taps themselves; only one individual in the house complained, and direct tests by an installation inspector and by his instruments showed nil voltage-to-earth. But an examination of the metal-tubed lighting installation showed that a phase-conductor was "down" in the garage, and that the conduit system was earthed to the water installation not at the rising water main but upstairs near the bathroom. Improving these conditions cleared the shock propensities of the water—the high-sensitivity householder confirming this.

In the second case, nurses in a certain institution reported that they got shocks from inmates when these were being bathed. So far as could be gathered, none complained of getting a shock when making a prior check of water temperature or when simultaneously touching tap-and-water or tap-and-patient. The cause was traced to a broken-down electric main in the grounds outside the building—the waste-pipe of the bath connecting the water in the bath to the "live" ground around the main.

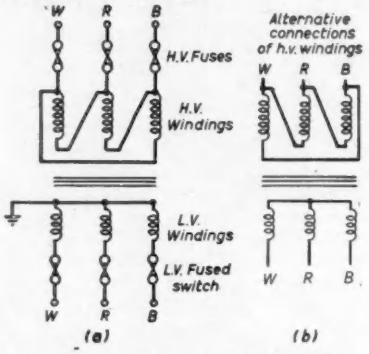
Shocks can be caused by strange and unexpected conditions. The two episodes described have factors in common that are often to be found. The breakdown of a live conductor can be comparatively remote; a local "earth" (of whatever kind) may become at a different potential from the general "earth" (earth mass); tap water, though a poor conductor, forms a better path in bulk and wet-connects the body; ordinary overload protection of a metal-encased installation is an unreliable safeguard as compared with earth-leakage protection.

Most leakages fortunately spread over a high-resistance path (which can be inclusive of the human body) and the current which passes is below a lethal value. This is a saving grace. But prevention is better than cure and it is vital (1) that compliance with the earthing requirements in the I.E.E. Wiring Regulations or other appropriate standard be *maintained* and (2) that advice and labour in all electrical work be informed and skilled.—*G. E. M.*

To Save Time

THERE are occasions when incorrect discrimination between h.v. and l.v. fuses, as shown in the diagram, means a h.v. fuse blowing and clearing a fault on the l.v. feeder. To ascertain which line is open-circuited, a quick voltage check across the l.v. line terminals in the l.v. switch in the cabinet at the base of the pole, is convenient. Assuming the R-W l.v. terminals have zero volts between them, then the R phase h.v. fuse has blown if the circuit is as shown in (a). If, however, the h.v. winding is connected as in (b), R-W zero volts on the l.v. side indicates that the W phase h.v. fuse has operated.

It is then essential that the diagram of the transformer connections be given in the switch cabinet for ready reference. This will save time in replacing the blown fuse which, being effected by ground-operated rods, cannot be a comfortable occupation after dark.



Alternative transformer connections to be borne in mind if incorrect discrimination causes an h.v. fuse to operate

To apply this method of information for all substations, I give below the following particulars:

Case (1) Transformer primary connection (a)

h.v. fuse blown	zero volts between
R phase ...	A and W l.v. terminals
W phase ...	W and B l.v. terminals
B phase ...	R and B l.v. terminals

Case (2) Transformer primary connection (b)

h.v. fuse blown	zero volts between
R phase ...	R and B l.v. terminals
W phase ...	R and W l.v. terminals
B phase ...	W and B l.v. terminals

In case (1), if the h.v. phases are crossed once, to give the order WRB or RBW (instead of RWB as shown) then conditions of case (2) apply. For a double cross (BRW) then the conditions remain as in case (1). In case (2), if the h.v. phases are crossed once, case (1) applies and if they are doubly crossed there are again case (2) conditions.—*E. N. A.*

NEWS OF THE WEEK

Growth of New Export Industries

B.o.T. survey shows how new exports increased trade

ELECTRICAL commodities figure prominently among the "new exports" which have helped to boost the U.K.'s overseas trade during the critical post-war period. The Board of Trade has recently analysed these new exports as an example of how British industrialists have adapted themselves to the changes in world demand, and by development of inventions and discoveries, and of new types of commodities, and a great deal of research and expense, have played a very large part in the expansion of our export trade. The analysis has been divided roughly into three parts; in the first instance it covers newly-developed industries and products. Secondly, there are those commodities which while produced here pre-war, were not exported to any appreciable extent until afterwards. Finally, there is a group of export industries who although important before 1939 have expanded their exports exceptionally rapidly since hostilities ended.

In the first category are such items as radio-communication and navigational equipment, television apparatus and industrial radio-frequency equipment. It is notable, too, that floor polishers are prominent here. These machines are relatively new in this country and the greater part of production is sold overseas. Electric hair-clippers and dry shavers are also comparatively new in the U.K., and sales both at home and abroad have risen greatly since 1945. Most notable among commodities in the second group is the fluorescent lamp, where exports were virtually negligible pre-war but have shown a substantial increase since. The same can be said of hearing aids and air conditioning machines for which America held almost a monopoly in world markets before the war.

Among the items for which exports have shown a remarkable expansion compared with pre-war and 1948, domestic electrical refrigerators and laundering and washing machines are high on the list. It will be recalled also that in these cases exports declined because of sterling area import restrictions imposed early in 1952, but they have nevertheless retained their importance in this group of commodity. The U.S. has traditionally been the largest exporting country in these items, and it stands to our credit that we have captured a large part of these markets. As regards refrigerators, for instance, pre-war export trade was negligible; by 1948 our exports had risen to 16% of the corresponding U.S. value, and by 1953 the U.K. proportion was 21%. Again in laundering machinery, U.K. exports were only about 16·6% of the corresponding value of American exports, whereas in 1948 they had risen to about 40% and in 1953 to about 75%.

London Consultants form Canadian Company

ONE of this country's most prominent firms of engineering consultants have announced the establishment of an associate company in Canada. The announcement was made by Mr C. H. P. Ewbank, chairman of Ewbank and Partners Ltd. last week. The new company, to be known as Ewbank and Partners (Canada) Ltd., will have its headquarters in Toronto, and will be under the direction of Mr J. T. Moore, director of the parent company and until recently chief engineer of English Electric Co., Ltd. It will act in close liaison with Crippen Wright Engineering Ltd., Vancouver. Mr C. H. P. Ewbank has accepted a seat on the Board of the Vancouver concern.

Anglo-Swedish Link to Promote Trade

COMMENTING briefly on the forthcoming Trade Fair in Stockholm (28 Aug. to 12 Sept.) in our issue of 15 Apr., we pointed out the importance of Sweden in terms of U.K. exports to the European continent. Only Holland rivals Sweden as Britain's largest market in Europe, and as stated then, Western Germany is taking a great deal of trade, and has in fact become Sweden's biggest supplier. The need to step up our activities in Sweden has not been overlooked and we are pleased to note the formal inauguration of a British-Swedish Chamber of Commerce.

Arrangements began about a year ago and over 250 firms in this country have indicated their willingness to join. An adequate capital and reserve fund has been provided by both British and Swedish founder members and the project has the full support of the Board of Trade and F.B.I. It is expected to be in full operation by the end of this summer.

The functions of the Chamber in Sweden will include the maintenance of British trade prestige; explaining Swedish needs to our exporters; stimulating interest in the market; promotional activities; and the provision of advice, marketing information, and market research. Mr R. Hunt Taylor is acting as hon. secretary and may be contacted at 41 Buckingham Palace Rd, London, S.W.1. (Tel.: Whitehall 6711.)

Credit for Brazilian Exports

EXPORTS Credits Guarantee Department has announced that it is to resume a limited cover on exports to Brazil. Cover will be limited to 80% of the credit granted; waiting period before loss is ascertained will be 12 months; there will be no cover for goods not of U.K. origin; and exchange sale notes will have to be produced covering all payments due. All fresh cover for Brazil was suspended in May 1952.

New Fuel Efficiency Service Operates from 1 May

TWO ideas are being considered by the newly formed National Industrial Fuel Efficiency Service as part of its reorganised aid to industry. The first is an invitation to firms to register for a regular service. This would entitle them to visits from skilled engineers on the staff of N.I.F.E.S. who would advise them regularly on general or particular problems. In the same vein, the second proposal involves the hiring, for a few months, of the services of an N.I.F.E.S. engineer, in cases where firms were doubtful of the justification of recruiting a full-time fuel engineer. These possibilities were mentioned by the chairman, Sir Leslie Hollinghurst, in a message to industry when the Service took over from the Ministry of Fuel and Power last Saturday.

All the various ways employed by the Ministry of helping industry to improve its fuel efficiency methods, will be continued, and general advice will still be free, but Sir Leslie pointed out that any substantial development in the scale of operations would only be possible if N.I.F.E.S. was able to earn revenue to supplement the support of the fuel industries.

Head office of the Service is at 71 Grosvenor St, W.1 (tel.: Hyde Park 9706), and the Scottish Office is at 145 St. Vincent St, Glasgow (tel.: Glasgow City 7636). In the course of the next few months it is expected to open district offices in Leeds, Manchester, Birmingham, Cardiff, and Bristol with sub-offices elsewhere. Meanwhile work will continue at the Ministry's regional offices in those cities as well as in Newcastle, Nottingham, Cambridge, Reading and Tunbridge Wells.

Minister Explains Award of Belfast Contracts

A DETAILED explanation of the placing of contracts for the supply and installation of seven boilers at the Victoria power station, Belfast, was given by the Minister of Commerce, Lord Glentoran, in the Ulster House of Commons last week. As reported last week Babcock and Wilcox Ltd., are to supply three of the boilers and Mitchell Engineering Ltd., the other four; total cost being £2,823,000.

The Minister explained that the final decision was based on the concurrent recommendations of two eminent firms of consulting engineers. Points of interest, however, were the reason why the contract was divided instead of awarding the whole to one firm and also whether or not either of the firms was the lowest tenderer.

Eight firms submitted tenders, of which four were ruled out on the question of price alone. The lowest tenderer proposed to incorporate stoker equipment completely unproved, and unsuitable for the Belfast station. Of the three remaining, one satisfied all prime requirements. They had experience of installing units of the kind and capacity wanted, and an organisation capable of providing the equipment most quickly. Lord Glentoran went on to say there was strong competition in price between the other two but the higher offer did not appear to offer sufficient inducement in other matters to justify added cost. Thus the choice lay between two, Babcock and Wilcox Ltd. and Mitchell Engineering Ltd.

The former could be relied upon to provide the most urgently required units by the due date, and that they could be commissioned almost immediately on installation. Mitchell's, however, were adjudged by the consultants not to have the same claim to immediate reliability and should be able to supply the first unit somewhat later. In all the circumstances it was decided to divide the installation between the two. Babcock and Wilcox Ltd. had been entrusted with the installation of the first three boiler units. By this it was hoped to achieve early delivery and an assured supply of steam to turbines. Units to be supplied by Mitchell Engineering Ltd. would be ready before required which would afford an opportunity for thorough testing and the curing of teething troubles which might have delayed the commercial commissioning of the first stage of the extension had the whole contract been allotted to the latter firm. This accommodation was reached in negotiation with the two firms. The Minister added that the same make of stoker would be included in the boilers provided by both companies.

Fact-Finding Tour by Pollution Committee

TO Manchester recently went the commendation that she led the world in the fight against smoke. This praise came from Sir Hugh Beaver, chairman of the committee set up last July to study the problem of air pollution. With five other members of the committee and five officials, Sir Hugh visited Manchester at the beginning of a fact-finding tour of England, Scotland and Wales. The party saw the city's smokeless zone, an iron foundry, modern appliances in council houses and the electrostatic precipitation plant at Agecroft power station. Their tour of the country was expected to include Glasgow, Edinburgh, Sheffield, Leeds, Rotherham, Birmingham, Cardiff and Swansea.

Sir Hugh stated that the committee was almost certain to issue its report by the end of the summer and certainly before the autumn.

ILLUMINATION CONGRESS AT MONTE CARLO

THIS year, at the invitation of the Municipality of Monaco, the Illumination Days of the French Association of Illuminating Engineers is to take place at Monte Carlo between 8 and 12 June. These days for the study of the various problems of lighting follow the most successful conferences which took place at Toulouse in 1952 and at Dijon last year. The overwhelming illuminations conjured up in those towns during the conferences attracted crowds of people, unconnected with the business, and the same display at popular Monte Carlo will almost certainly attract larger crowds. The programme for illumination schemes during the 1954 Congress is now being prepared and the installations will remain during the whole of the summer season.

The business programme will fall under the heading of "Light and Tourism" and subjects to be discussed include the illumination of parks and gardens, monuments, lighting at sporting events, in cars and on the roads. Further information may be obtained from the Comité d'Organisation des Journées de l'Eclairage, Marie de Monaco.

E.A.W. Investigation of Smoke Pollution

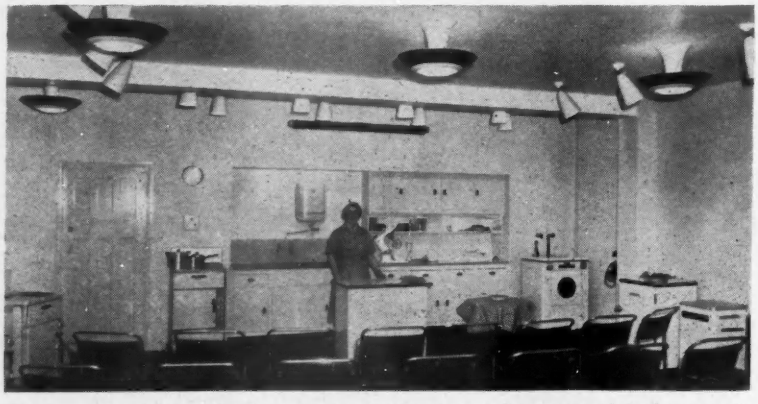
THE housewife's point of view on smoke pollution has been collated by the Electrical Association for Women and submitted as evidence to the Government's Committee of Enquiry into the Causes of Air Pollution. The investigation was undertaken because there appeared to be no information available as to the effect smoke had on household washing and consequently on household budgets. The difference in the family wash in various parts of the country was therefore the main aim.

Scope of the enquiry fell into four sections. In the first place manufacturers and research organisations were asked about the relative soiling of curtains and furnishings. Secondly, electrical housecraft advisers were asked for their views on such matters as the frequency with which people in various towns had to paint their houses, and wash their curtains. The Association also carried out practical experiments on net curtains hung in six localities. Finally there was the questionnaire sent to housewives. This sought the locality in which they lived, size of families and the size, cost and time of the laundry done at home.

Comparison between smoke-free and smoke-polluted areas enabled E.A.W. to assess the effects on home budgets of fog and smoke. It was found, for instance, that in industrial areas the weekly wash weighed 17 lb and cost 2s. 5d., and in rural areas, 13 lb and cost 1s. 10d.

Formation of Stone-Chance

IT was announced last week that J. Stone and Co. (Holdings) have bought the engineering interests of Chance Bros. A new company, Stone-Chance, is to be formed with Mr B. Preston, deputy chairman of J. Stone, as chairman, and Mr J. Raymond, managing director of Chance Bros. as managing director. The two principal subsidiaries, Sumo Pumps and Austinlite will continue to handle pumps and electrical equipment.



The Jersey Electricity Co. Ltd. have just completed extensive alterations to their showrooms in Broad St., St. Helier. Above is the demonstration kitchen rebuilt on modern lines and equipped with every type of electric appliance. The company is now campaigning extensively in the cooker market and has already achieved a great deal of success

Willoughby Lane, Tottenham, before and after the conversion from gas to sodium street lighting. The equipment was supplied by British Thomson-Houston Co. Ltd.; columns by Concrete Utilities; contractors were N. Midlands Engineering Co.; and supply authority, Eastern Electricity Board. Open sealed refractor lanterns were used throughout, mounted at height of 25 ft. These lanterns are "Perspex" units with many of the advantages of a closed unit but considerably cheaper. They are easily cleaned, light in weight, simply installed, and almost totally weatherproof

London's Trolleybuses to be Scrapped

LARGE-SCALE plans to replace London's trolleybuses were announced by London Transport last week. The conversion will come into operation in about three years' time. The whole of London's electric-trolleybus fleet, with the exception of a few in the south-western suburbs, are to be replaced by diesel oil buses of a new lightweight type. The announcement points out that the vast majority of trolleybuses now in service will have completed their useful lives by that time and maintenance would become heavy and uneconomic. The new lightweight diesel oil buses will be larger than hitherto, carrying 64 passengers, more than the same type now running, although less than the 70 seater trolleybus.

The L.T.E. state that there will be no waste of power station capacity because the full capacity of their own power stations will become available for other needs, notably on the Underground.

Commenting on the conversion plan, an official of B.E.A.M.A. said it would probably have an adverse effect on fares, because oil was imported and supply was subject to control overseas, whereas electricity was "home produced." Trolleybuses, he said, moved the greatest possible number of people in the shortest possible time, and in a year carried 75 million more people than the Underground. He added, "It is a retrograde step, adding to transport problems and bound to cause dislocation and inconvenience to the public."

New Wayleave Rates for Landowners

WE HEAR that new electricity wayleave rates, payable to farmers with distribution lines crossing their land, are to come into operation as from the first payment after 30 June. The new rates have been agreed between the Electricity Boards, the N.F.U. and the Country Landowners' Association. It is noted that double compensation is to be paid in respect of land where two crops are taken in a year. Where wayleaves have already been agreed at a higher rate than the new schedules, no reduction in payments will be made. Compensation will be paid to the landlord, who will in turn pay the tenant the appropriate amount.

Future of Glasgow's Transport System

GENERAL manager of Glasgow's Transport Undertaking, Mr E. R. L. Fitzpayne, has asked the Corporation's transport committee for a statement of policy regarding the future of the city's transport system. His advice is to extend trolleybus services where it could be justified and convert some routes to motor bus operation, or alternatively, if it is considered advisable to adopt motor buses throughout, then the policy concerning Pinkston power station should be reviewed. In his report, just issued, the two main factors discussed are the implications of expenditure of £2¼ million on Pinkston power station since 1947 and the existence of 450 trams which are becoming obsolete. The report has been submitted to the Municipal transport committee who are to remit to a subcommittee appointed last year.

Birmingham Exchange to open on 17 June

A DATE has now been fixed for the opening of the new Birmingham Exchange and Engineering Centre. It is 17 June and the ceremony will be performed by Lord Bennett. As has been previously reported, the centre is designed to be a permanent exhibition of British industry and shop window for our latest products. Over 200 firms are exhibiting and all exhibition space has now been taken.

Atomic Energy is not a Threat to Miners

IF Britain is to keep in the industrial race with other countries of the world, by 1964 our power stations will require an extra 15 million tons of coal a year, said Dr Jacob Bronowski, director of research at the N.C.B.'s Stoke Orchard research centre, in Manchester last week. In 20 years' time that figure would be increased to 30 million tons for power stations, but there was no prospect of coal production increasing by that amount. The expected expansion in output would probably be absorbed by increasing industrial consumption, domestic use and exports. The margin would have to be made up by atomic fuels, but the maximum one could expect from atomic power in the next ten or twenty years was energy equivalent to that provided by 20 million tons of coal per year. Dr Bronowski added that a gap of 10 million tons remained, and consequently there seemed little likelihood of any miner losing his job by the development of atomic energy.

TRAINING IN HOUSECRAFT

FOUR more scholarships to enable girls to take a domestic science training course at a recognised college before entering on a career in the electrical industry, have been awarded by the Caroline Haslett Trust. The successful girls are Miss Angela Murr, of Epsom, Surrey, Miss Judith Turnbull, of Tynemouth, Miss Vivien Pedley, of Burley-in-Wharfedale, Leeds, and Miss Veronica Hurst, of Smethwick. To date 49 scholarships have been awarded.

The First Half-Century

The sting of the report of the committee appointed to inquire into the use of electricity in mines is appropriately situated in the tail. The committee was most anxious to promote the use of electricity in mines, but it also realised its responsibility for any accident which might occur against which it had made insufficient provision. Hence the appended regulations are apt to err on the side of undue stringency. One clause provides that every motor transformer or arc lamp shall be controlled by an efficient switch, which seems to prohibit the running arcs in series, a regulation the more absurd since the arcs will only be used above ground. Another provides for earth or fault detectors to show any defect in insulation; it has been suggested that lamps will provide a cheap and efficient substitute. Again it scarcely seems necessary to put a switch on each pole of a circuit carrying more than three amperes in addition to a cut-out or fuse. Telephonic communication is hardly a necessity anywhere, but if needed in mines at all, why only in those electrically worked?—*From our issue of 5 May, 1904.*

Electrical Work by Direct Labour at Dunfermline

ALMOST all the electrical work to be carried out on council property at Dunfermline will be by direct labour. A motion to this effect has been approved by the town council. The motion approved, provided that all electrical work in corporation property should be executed by the Baths Electrical Dept. if the work was within their capabilities. This would not apply in cases where a Government Department or other outside body was financially interested, and asked for competitive tendering, but the corporation's electrical department should then be able to submit a tender. The existing practice of inviting tenders by public notice should be superseded.

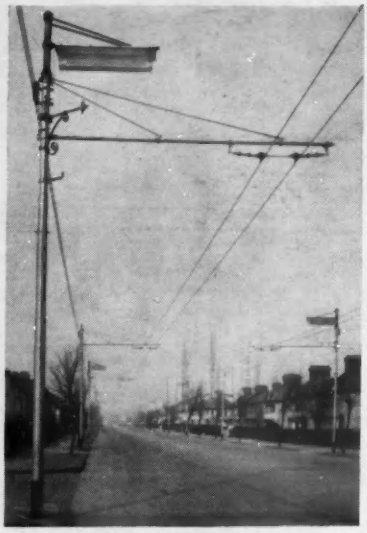
The motion was designed to bring the Electrical Department into line with the Public Works Department which was entirely separate. It was stated that the Department was fully capable of carrying out their tasks cheaply and efficiently, and it was thought that the ratepayers would benefit. Opposition was plentiful and based on the fact that when trying to get the best the council should endeavour to get the keenest prices. The method proposed had been tried by various local authorities and found to be unsuccessful.

Prizes for Apprentices

FOLLOWING our recent note of the success of Standard Telephone apprentices in the instrument section of the Physical Society's competition, we hear of similar successes of E.M.I. Engineering Development Ltd.'s apprentices in the draughtsmanship competition. First prize in the senior section went to apprentice Mr G. Charnock, of Alperton, who has just completed his indentures. In the junior section, second prize went to Mr P. Bagley, of Farnham Common, who has been with E.M.I. nearly two years.

Which Feature of Cooker is Most Important?

PROS AND CONS of ten attributes of electric cooking have been examined and a decision reached in the judging of British National Electrics' annual electric cooker competition organised at the Ideal Home Exhibition. The final order of those attributes was decided as follows: perfect baking, easy cleaning, low running costs, precision stewing, cleanliness of kitchen, perfect grilling, no fumes, accurate oven temperature, preservation of flavours, and large hot cupboard. Six out of every ten entrants placed one of the first three features chosen by the adjudicators at the top of their lists. Two entrants tied for first prize of the company's C.49 cooker, an unusual occurrence, and each was presented with a cooker, water heater and fire. There was a bicycle for the winner of the junior section, for those under 17



Mounting of streetlighting lanterns on trolleybus columns in Belfast. "Three eighty" fluorescent lanterns, supplied by the G.E.C. have special brackets to clear the buses' catenary wires. A total of 122 fittings were provided

Tokens for Meters to Stop Thefts

AN INCREASE of 100% in the number of thefts from meters during 1953 has led to a further appeal to gas and electricity authorities to introduce a system of tokens instead of coins. The proposal has been made by the Chief Constable of Wallasey in his annual report for 1953. The report states that although cases of simple larcency decreased, the reduction was offset by thefts from meters which almost doubled those of the previous year. These crimes had risen from 65 in 1949 to 92 in 1952 and 183 in 1953.

The chief constable considers the use of coins for meter supplies encourages dishonesty, and despite his pleas for an alternative method, nothing had been done. Token discs were not negotiable, and he thought gas and electricity authorities should get down to the task of removing the incentive to crime and reward for dishonesty.

Charting at Batti-Wallahs

MARINE surveying and the work of the Navy's Hydrographic Department in preparing a range of charts and navigational publications which is second to none in the world was the subject of a most interesting talk given by Admiral Sir Guy Grantham, at the monthly luncheon of the Battiwallah's Society.

This occasion was notable in that the new president Mr C. N. Good was invested with his chain of office and took the chair. The retiring president Mr A. G. Freeborn received his past president's badge and at the invitation of the new president made an appropriate speech proposing the vote of thanks to the Guest of Honour.

WORK STUDY CONFERENCE

LATEST developments in the practice of work study will be explained to industrialists at a conference being organised by the British Institute of Management at Harrogate between 27 and 29 May. The conference will follow similar lines to that held last year by the Association of British Chemical Manufacturers and I.C.I. Ltd., for the chemical industry. In fact, the latter company is taking a large part in proceedings. It is by no means confined to the one industry, however, and every effort is being made to ensure that every industry is covered. This endeavour is exemplified in the long list of discussion groups for the application of work study in various fields. Medium and Heavy Engineering, Light Engineering and the Light Electrical Industry are but three of 19 groups.

A.E.M.T. CONVENTION

ANNUAL Convention of the Association of Electrical Machinery Trades took place this year at Swanage in Dorset, and was said to have been the most successful yet held. Over 60 members and their ladies were present. It has been decided to hold the 1954 general meeting of the Association in London on 21 June. Two papers were read at the meeting. The first by Messrs A. E. Feaver and G. Batho was entitled "Electrical Uses of Carbon," and the second by Mr A. Clive Lane was on "Variable Speed Motors for Use on a.c. Supply." Social events included the official luncheon, a dinner and dance, a coach tour for the ladies, and, we understand, frequent visits to the miniature golf course.

BR's. First Diesel Light-weight Cars

THE first train to be built under the British Transport Commission's £2 millions programme for the development of lightweight diesel driven passenger services on British Railways was demonstrated last Thursday in a trial run between Marylebone and Beaconsfield. As already announced, this programme provides for the introduction of multiple-unit diesel railcars in six areas where they will both substitute and augment existing steam services.

In the unit demonstrated, extensive use is made of light alloy metal. Bodies and underframes are fabricated as one unit and together with the four 125 h.p. Leyland power units (two to each car) and 232 gallons of fuel, the weight of the two car unit is 54 tons. Transmission from each engine to the driving axle of each four-wheeled bogie is either direct or through a torque converter, the latter being used for acceleration. At 30 m.p.h. drive is transferred to direct, by which the train completes its acceleration to a maximum speed of 62 m.p.h. All control of engine speed and drive transfer is by conventional electro-pneumatic methods.

Brighton celebrates Charter Centenary

ONE of Britain's famous holiday resorts is celebrating the centenary of its Charter. That resort is Brighton, where appropriately enough, electricity has played a major part in the history of the Royal borough. She does in fact claim to be the first in England, if not in the world, to generate electricity off the consumer's premises and supply it from a central power station. Credit for that should of course go to the Hammond Electric Lighting Co., but it was in Brighton and that is what matters. The Corporation's own power station was opened in 1891, and the greater generating station at Southwick in 1906. At the present day Brighton's great contribution to both the supply and manufacturing sides of the industry is undisputed.

Defective Lamp causes Fatal Accident

A VERDICT of death through misadventure was returned at a recent Douglas (Isle of Man) inquest on a man electrocuted when he handled a defective lamp. It was stated that the accident would not have occurred if the Island's electricity regulations had been the same as those in force in England. Mr H. F. Fryer, chief assistant engineer to Douglas Corporation, agreed with the coroner that there were no provisions in the Island to prevent the type of accident which had occurred, but it was adequately covered in the English Factories Acts which stipulated that electricity points of the kind concerned, should be earthed or an insulated shroud placed over the electric light holder. Mr Fryer said the defect might have developed after manufacture but he doubted it.

There were, he said, three reasons for the fatality. There was a defect in the lamp; there was no earthing wire; and there was no shroud over the lamp holder. The jury made one observation. During an inspection of the premises it was noticed that two other points existed which could cause a similar accident. It was hoped the necessary precautionary measures would be taken at once.

NEWS IN BRIEF

Commissioners of Customs and Excise have revised their Notice No. 78 concerning goods chargeable with Purchase Tax. Copies of the new edition are being sent to Trade Associations and trades registered for P.T. purposes. The revised Notice supersedes Notices 78 and 78G issued in January, 1953, and January, 1954, respectively.

Annual licence fee for mobile radio users is to be reduced from £5 to £3 as from 1 June.

The Duke of Portland, Lord Lieutenant of Nottinghamshire, is to lead a deputation to the N.C.B. to protest about smoke pollution.

A year ago the Express Light Co., Ltd., received an order for four 3-ton single-speed goods lifts for Gold Coast's Takoradi Harbour scheme. A further order for another five lifts has now been received.

Eight showcase models depicting the progress in electrifying houses between 1851 and 1951 and exhibited at E.A.W. headquarters during the Festival of Britain have been presented by the Association to Bradford Technical College. They were made by a Bradford firm.

The third Gothenburg (Sweden) Home and Household Exhibition is to take place from 4 to 12 September.

Copies of the annual report of the Council for the 1953-54 session and of the accounts for 1953, to be presented at the annual meeting of the I.E.E., on 20 May, may be obtained from the secretary.

First National Convention organised by the Institute of Materials Handling, took place at Didcot on 29 April. Theme of the convention was Industrial Trucks and Methods.

B.V.C. industrial type vacuum cleaners were chosen for use aboard the Royal Yacht *Britannia*.

Tenants of 138 council flats at Newdyke, Kirkintilloch, are to be given the choice of gas or electric cookers provided a satisfactory arrangement regarding the hiring or purchase of electric cookers by the town council can be made with the electricity board.

Window bills advocating Ekco television sets for viewing this season's cricket, the proposed second programme, and H.M. the Queen's homecoming are available to dealers.

Cable and Wireless Ltd.'s new cable ship *Recorder* was launched at Newcastle last Monday.

ELECTRIC SUPPLY NEWS

B.E.A.

THE Authority is to close down about 20 small diesel power stations having an aggregate capacity of 9,000 kW. The question of other work for some of the staff involved has been the subject of recent discussions with the trade unions concerned and the Joint Advisory Council.

Bolton

THE Corporation Planning and Estates Committee has decided to seek the advice of electrical consultants on alternative proposals to those of the B.E.A. for the erection of 275 kV transmission lines across the west and north of Bolton. The Lancashire branch of the C.P.R.E. is to share the cost of engaging the consultants.

Malvern

THE local electricity undertaking is celebrating its jubilee this year—the original station was a combined refuse destructor and electric lighting works. Referring to the development, Mr W. S. Lewis, chairman of the Midlands Electricity Board, has said that capital expenditure on the undertaking over the 44 years up to 1948 totalled only £151,000—about £30 per consumer—very little capital work having been done in the middle 1920s, and as a result the outstanding debt of the undertaking was only about £20,000. The Board considered the distribution system was outmoded and inadequate to meet the needs of the population. The new system, together with standardisation of voltages, was estimated to cost £400,000 plus nearly £100,000 for h.v. lines and transformers. To date work involving £107,000 expenditure had been approved, and three large schemes were well under way. It is expected that it will be four years before Malvern's new distribution system is complete.

Northern Ireland

THE Northern Ireland Fire Authority is to seek a discussion with the Ministry of Commerce regarding the charge to be made for the supply of current to the Authority by the Electricity Board for Northern Ireland. This was decided upon at a meeting of the Authority in Lisburn when it was stated that the Boards estimate was £203 for providing a supply of electricity to a new fire station in Lurgan. The Fire Authority is to urge that its consumption should be treated as a whole by the Electricity Board instead of on a piecemeal basis.

Settle

THE Rural Council has given formal approval to a proposal for an overhead line to take electricity up the Littondale Valley. Earlier the Council had advocated that the line should be placed underground over the whole length in view of the high scenic value of the dale, or that the cables should be buried in the villages of Arncliffe and Hawkswick.

Lighting Schemes

Belfast. The Corporation Police committee has recommended the replacement of existing mercury vapour lamps in Chichester St by horizontal fluorescent lamps.

Cambridge. The City Council is being asked to approve street lighting improvements in Abbey Rd and Beche Rd, Bateman St, De Freville Ave, Derby Rd, Fitzroy St and Haig Rd and Cam Rd, at a cost of £2,086.

Colne (Lancs). T.C. to prepare schemes for conversion of lights in four streets to sodium vapour lamps.

Exeter. Ministry consent has been obtained to the borrowing of £12,879 for the provision of the remainder of the improved street lighting scheme.

COMPANY ACTIVITIES

CASH is still the need of Brush Electric, the diesel engine, electrical equipment concern which was at one time bossed by the late Alan Good. Despite last year's new issue of £940,000, the balance sheet shows bank overdrafts in the neighbourhood of £6 millions. But the over-all feeling is that the group is nearing the final stages of its financial and managerial re-organisation. The year under review should have seen the last of the unhappy Indian tube well operations which to the end of 1953 had resulted in a net loss of £469,000. These operations are now to be closed down completely, entailing a further loss of £250,000, which has already been covered by reserves.

Next obstacle is keener competition, which last year resulted in a fall in demand for smaller diesel engine products. Despite this the net intake of orders exceeded the figures for 1952 while the demand for heavy equipment has been well maintained into the present year. However, the chairman reports that the intake of orders is still below production. Low prices and short delivery dates are essential if incoming orders are to be increased. No great difficulty is generally anticipated in speeding up deliveries, though the continued upward trend of wages is threatening the group's ability to compete on price, especially with German manufacturers.

Intensified competition was probably the cause of a £231,000 drop in trading profits of London Electric Wire Co. and Smiths, to £1,076,000. But here again is another instance of the tax cushion, as net results actually show an improvement. In this case total tax assessment is £256,000 down at £540,000 leaving a net surplus of £26,000 higher at £536,000. So that despite the fall in gross earnings, the board feels no compunction in actually increasing dividend payment, allowing for the 100% share bonus earlier in the year.

The actual comparison is an equivalent of 10% against 7½% and the new rate of dividend is covered nearly four and a half times after a bigger transfer of £34,000 to the Workers' benefit fund.

It is quite probable that the fall in the profits of Control Systems from £328,000 to £284,000 will be only temporary. The group has bravely embarked upon a wide expansion programme since the war and the chairman anticipates "quite a good year" in 1954. The products now cover a wide range in a specialised field. It is probable that profits at home last year were checked by delays in the production of two new types of electrical calculating machines, while abroad, there was an operating loss incurred by a U.S. subsidiary due to heavy development costs. The other main outlets are in Australia and New Zealand and trade in the former made a notable improvement. In New Zealand where the group operates race-track totalisators, results suffered from two items—reduced turnover on on-course betting, and low profit margin.

Rather boldly, I think, the board have decided to again pay 16% including a 2½% supplementary dividend, although it takes nearly all the available earnings. This cuts things rather fine and allowing for dividend in the price, the 5s. shares at 14s. give the somewhat high yield of 5¼%.—*From our City Correspondent.*

Albright and Wilson Ltd.

The abnormally heavy expansion programme undertaken during the last few years is now nearing completion, Mr K. H. Wilson, the chairman, states in his review of the year 1953. The group have spent nearly £11 millions on the extension of manufacturing facilities in the last three years. The group trading profit for 1953 is £2,790,254 compared with £2,272,014 for the previous year. The dividend is increased to 17½%.

Automatic Telephone and Electric Co.

The group profit for 1953 amounts to £1,441,393, which is over £300,000 above the figure for the previous year. The 15% dividend is being repeated with a final of 12% on the Ordinary shares. In addition it is proposed to make a 10% free scrip issue, subject to Treasury consent, which will take the form of one new £1 Ordinary share for each £10 Ordinary and/or Deferred stock held, involving a total of 190,400 new shares.

Babcock and Wilcox Ltd.

For the year ended 31 Dec. last the group profit, excluding two foreign subsidiaries, is £4,149,618, as against £4,605,018 for the previous 12 months. U.K. taxation absorbs £2,612,415 this time—over £600,000 less than before. The final dividend is 7% on the larger capital, making 12½% for the year—equivalent to the 18% paid on the smaller capital for 1952.

Brush Electrical Engineering Co. Ltd.

The year ended 31 Dec. last was a period of keen price competition both at home and particularly in the overseas market, Sir Ronald W. Matthews, chairman, reports. The fall in turnover he considers inevitable, but the rate of gross profit earned by the group's English factories was almost the same as in 1952, he adds. The net intake of new orders both for the home and export markets exceeded the figures of 1952 and the year closed with an improved trend which has been maintained during the first quarter of 1954. But the order intake is not yet equal to the group's production. Regarding the Indian tube well project, Sir Ronald reveals that it has been decided to undertake no further contracts, and make efforts to sell the subsidiary as a going concern.

Year to Dec. 31	£ Trading Profit	£ Net Profit*	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1949	2,017,756	614,382	66	10	7/4	4/10
1950	2,496,525	653,552	47	10	7/1	4/9
1951	2,674,169	524,668	39	10	7/10	5/5
1952	2,466,250	136,990	8	4	6/4	4/1
1953	2,159,485	404,078	7	6	5/4	2/11

* Available for parent company.

T. Clarke and Co. Ltd.

A final dividend of 9% again makes a total of 18% for the year ended 31 Dec. last. The consolidated net profit, after taxation, for the period is £12,111, compared with £10,391 a year ago.

R. and A. G. Crossland Ltd.

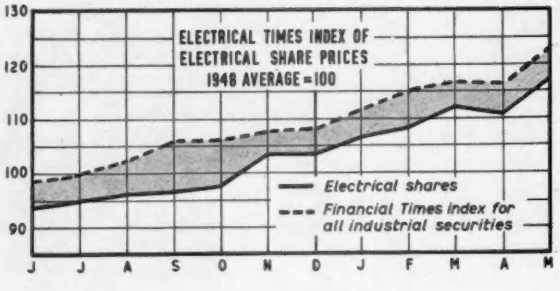
The dividend for 1953 is to be 22½%, the same as before. The consolidated group profit for the year is £65,453 (*£61,299*) subject only to taxation of £34,632 (*£32,599*). The company manufactures electric lighting equipment, pressings, etc.

Davis and Timmins

A final dividend of 15% plus a bonus of 5% makes a total of 25% for 1953. The group net profit for the period is £47,704. The directors report that owing to unfavourable conditions during the year, production was for a time on a restricted basis and many prices were unremunerative. Business improved, however, and by the end of the year the works were again in full production.

H. T. Enthoven and Sons

With the consolidated net profit, before tax, reduced to £103,825 for 1953, the dend is cut to 20% (*30%*).


ELECTRICAL TIMES INDEX OF ELECTRICAL SHARE PRICES 1948 AVERAGE = 100
130
120
110
100
90
Electrical shares
Financial Times index for all industrial securities
J J A S O N D J F M A M

Share prices jumped during April. Both indices shown here rose considerably. The "Financial Times" index for all industrial shares increased from 116·3 to 122·9, and at the same time the "Electrical Times" index for electrical shares rose by 5·5 to 117·1

Enfield Cables Ltd.

After absorbing losses of Brynmawr Rubber Co. and its subsidiaries amounting to £238,985, the group profit dropped to £57,494 for the year ended 31 Dec. last. For the previous year the profit was £404,858. In view of the results and the unsatisfactory current trading position the directors do not recommend any dividend on the Ordinary stock. A total of 5% was paid for 1952.

Louis G. Ford Ltd.

This firm of electrical wholesalers, builders' merchants, etc., reports a consolidated net profit of £36,736 for 1953, compared with £39,515 for the previous year. The final dividend is 11¾%, making a total for the year of 21¾%.

W. N. Froy and Sons

This concern of builders' merchants, electrical engineers, etc., report a dividend of 12½% (*same*). The profit amounts to £55,974, which is over £22,000 more than for the previous year. After all charges, including taxation, the balance is £21,817 (*£11,750*).

Glenfield and Kennedy Ltd.

The directors have been considering the financial structure of the group, and in particular the capital requirements in view of the continued development of the business. It is estimated that about £400,000 of additional capital will be required which it is suggested should be raised by the issue of Preference shares, while the existing "A" and "B" Preference stock would be converted into one new class. At the same time it is considered that the administration of the group would be simplified and improved if the parent company acquired the Preference shares of its subsidiaries, Alley and MacLellan Ltd., J. Blakeborough and Sons, and the remaining Ordinary shares of Blackett Hutton and Co., so that these subsidiaries become wholly owned. Under the proposals, which have been approved by the C.I.C., the share capital will consist of £1,000,000 of 5½% Cum. Pref. stock of which £310,000 have been issued, and 1,800,000 Ordinary £1 shares of which 1,710,000 have been issued. Further proposals would increase the 5½% Pref. to 1 million. Power is reserved to create and issue a £500,000 Pref. to rank pari passu with the £1m. stock. Meetings are to be held on 21 May to consider the proposals.

Hall Telephone Accessories Ltd.

A 10% dividend is again being paid for 1953. After charging taxation, the profit for the period is £20,049, compared with £22,722 for the previous year.

Hopkinsons Ltd.

The increase in the trading profit for the year ended 31 Jan. last is a reflection of the expanded production during the period. Export orders received during the twelve months were 14% above the figure for the previous year (when there was a falling off). But export sales were in excess of orders and the backlog of outstanding orders has been reduced, it is stated.

Year to Jan. 31	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	627,688	275,162	136	22½	5½	87/6
1951	844,484	349,939	183	25	6¼	5¼
1952	868,022	345,380	181	27½	5½	96/10
1953	921,366	350,137	176	32½*	81/6	60/–
1954	1,002,048	392,632	94	25	86/6	78/9

* Plus 100% Capital bonus.

Johnson and Phillips Ltd.

This company suffered a slight setback in its trading profit for 1953, it will be seen from our table. This was probably not unexpected in view of the difficulties which have affected many of the cable manufacturers during the year. Stock-in-trade and work in progress for J. and P., including the South African and Australian concerns, is listed at £2,952,624 at the end of December last, against £3,627,528 a year earlier. For the Scottish group (Aurora Lamps and British National Electrics) stock-in-trade, etc., is valued at £248,819 (*£302,834*). The Scottish group's trading balance is £6,021 (*£15,696*).

Year to Dec. 31	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1949	606,871	256,581	35	15*	66/–	56/2
1950	504,834	211,295	30	15	64/–	58/9
1951	803,796	375,031	52	15	68/3	54/–
1952	706,366	285,656	34	15	55/–	45/–
1953	602,298	214,018	21	15	59/3	49/–

* Plus 25% Capital bonus.

London Electric Wire Co and Smiths Ltd.

A final dividend of 7½% is recommended on the capital which was enlarged last December by a 100% free scrip issue. This makes a total of 12½% for the year, against 15% for 1952 on the smaller capital. The group profit for 1953 amounts to £1,237,169—some £280,000 below that of a year ago. But with taxation requiring £256,000 less than before, the net profit is over £16,000 up. In the full report, the value of the stock in trade at 31 Dec. last, less provision for stabilisation of commodity prices, is given as £1,780,738, which is nearly £500,000 less than a year ago, which seems to indicate that with fluctuating metal prices, stocks of copper, etc., have probably been reduced.

Sayings OF THE WEEK

"During the cold snap last winter, when the system (in Malvern) was under considerable strain, engineers had to be on duty watching some of the 'museum piece' street kiosks, ready to switch off when smoke appeared." . . . MR W. S. LEWIS, chairman. Midlands Electricity Board, speaking on reorganisation at Malvern.

"It should be part of the training of every scientist in industry to spend six months trying to sell the goods he manufactures." . . . MR N. SHELDON in the *Daily Telegraph*.

"The corollary to make do and mend is to get busy and spend—spend for posterity, in bricks and mortar, steel, cement and machinery." . . . SIR HARRY PILKINGTON, speaking at Birmingham.

Year to Dec. 31	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	928,408	304,210	62	10	53/9	42/–
1951	1,395,741	520,461	96	12½	55/3	42/6
1952	1,518,265	520,580	92	15	52/6	36/6
1953	1,237,169	536,395	44	12½*	76/–	51/9

*Plus 100% capital bonus.

Power Investment Corporation Ltd.

For the year ended 31 Mar. last the net revenue is £27,323 (*£24,330*) after charging taxation, etc. The dividend is raised by 1% to 3%.

Ransomes, Sims and Jefferies Ltd.

There is again a 7½% dividend but this time on the increased capital. The group trading balance for 1953 is £337,404 compared with £454,563 for 1952. That figure is struck after charging depreciation of £94,047 (*£85,404*), setting aside £61,500 (*£72,500*) for increased cost of plant replacement and after transferring £20,000 from reserve for flood damage.

Wm. Sanders and Co. (Wednesbury) Ltd.

This concern has reduced its dividend to 15% for the year ended 31 Dec. last—for the previous year 20% was paid. The net profit for 1953 amounts to £18,409 subject only to taxation of £11,313, whereas for the previous year the total was £28,804 with taxation at £16,807.

Ship Carbon Co. of Gt. Britain Ltd.

The Ordinary dividend is increased by 2% to 20% for 1953. The net profit for that year is £94,172—nearly £5,500 more than a year ago.

Dividends Declared

Frederick Braby and Co. It has been decided to defer a decision regarding payment of an interim Ordinary dividend until more information is available about the results to be expected from operating the company's new plant at Crayford and Glasgow. Last year there was an interim of 2½% and final of 12½%.

Brazilian Traction, Light and Power Co. Dividend of 50 cents per Ordinary no par-value share.

Burco Ltd. Interim of 7½% on doubled capital, against 5% last year.

Electrical Apparatus Co. Interim of 7½%. The directors state that it must not be assumed that the total distribution will be more than the 20% forecast last December when the Ordinary shares were introduced to the London market.

Sperryn and Co. Interim 4% (*same*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

7 May—Belfast T.C. CO_2 fire fighting equipment.—Advertised in 1 Apr. issue.

7 May—Belfast T.C. Primary current injection testing set.—Advertised in 15 Apr. issue.

7 May—Edinburgh T.C. Stand-by generating set for civil defence building.—See 29 Apr. issue.

8 May—Leicester T.C. Street lighting equipment.—Advertised in 22 Apr. issue.

10 May—Birmingham. Three air compressor sets for Tame and Rea District Drainage Board.—See 15 Apr. issue.

10 May—Hendon T.C. Lighting installation at St. John's C. of E. school in Milton Rd. Applications by above date to Borough Engineer and Surveyor, Town Hall, N.W.4. Deposit £2. 2s.

11 May—N. Ireland. Electrical installation in 40 dwellings at Whitehead, Antrim. N.I. Housing Trust, 12 Hope St, Belfast. Deposit 10s.

12 May—Bath T.C. Electrical installation at Henley Tyning farm and buildings. City and Waterworks Engineer, 8a Terrace Walk.

12 May—Swanage U.D.C. Supply and erection of eight flashing beacons for pedestrian crossings. P. S. Browne, Surveyor, Town Hall.

13 May—Newcastle-on-Tyne T.C. Electrical installation at Sackville Rd civil defence control centre. P. Parr, city engineer, Town Hall.

14 May—Belfast T.C. Installation at Power Station West (Tender No. N.1519) of portable fire fighting appliances.—Advertised in 29 Apr. issue.

15 May—Blackpool T.C. Equipment for street lighting.—Advertised in 22 Apr. issue.

15 May—Halifax T.C. Supply of following street lighting equipment during 1954-55: concrete columns; sodium discharge lanterns with transformers, capacitors and 60 W and 140 W lamps; and tungsten lanterns for 100 W lamps. Public Lighting Superintendent, Public Lighting Dept., 44a Hopwood Lane.

15 May—Musselburgh T.C. Street lighting at Fisharrow, Eskside West, and along Heddington Rd.—See 29 Apr. issue.

15 May—Romford T.C. Supply of two electric street orderly trucks. Town Clerk, Town Hall.

15 May—Salford T.C. Lamps and cables during year from 1 July.—See 22 Apr. issue.

15 May—Walsall T.C. Electrical equipment in home for aged persons in Princes Ave.—See 29 Apr. issue.

17 May—Glasgow T.C. Traction batteries for cleansing dept.—See 15 Apr. issue.

17 May—Longbenton U.D.C. Electrical installation in 30 houses on Kelvin Park estate and 4 on Holystone estate. Same in 44 houses on Croft estate. Two contracts. A. E. Sweetman, Engineer and Surveyor, Council Offices, Forest Hall, Newcastle-on-Tyne. Deposit £2. 2s.

17 May—N. Ireland. Electrical installation in 400 houses at Larne, Antrim. N.I. Housing Trust, 12 Hope St, Belfast. Deposit 10s.

17 May—Port Talbot T.C. Installation in about 96 houses at Goytre.—Advertised in 29 Apr. issue.

17 May—Stepney B.C. Installations in flats in Sidney St. scheme.—Advertised in 1 Apr. issue.

17 May—West Riding. Rewiring of Aldwick-le-Street Highfields school. — See 15 Apr. issue.

17 May—West Riding. Rewiring of installation at Conisoorough Northcliffe Rd secondary school. County Architect, Bishopgarth, Westfield Rd, Wakefield. Deposit £2. 2s.—Advertised in this issue.

18 May—Co. Antrim. Installation at Ballymoney primary school.—See 29 Apr. issue.

18 MAY—Belfast T.C. Supply of (*a*) stationary set of compressed air plant comprising duplicate electric motor driven air compressors and receivers; and (*b*) portable electric motor driven air compressor and receiver. Tender No. 968. Transport Dept., Sandy Row Depot.

19 May—Birmingham T.C. Supply of various street lighting equipment in year from 1 July. City Engineer and Surveyor, Civic Centre.

20 May—Belfast T.C. Modifications to electrical installation in primary school in Cliftonville Rd. Education Architect's Department, 40 Academy St.

20 May—Willesden T.C. Invitation extended to contractors for inclusion on list of approved contractors for installation of lighting and power supply. Applications by above date to J. C. Morris, Borough Engineer and Surveyor, Town Hall, Dyne Rd, Kilburn, N.W.6.

21 May—Edinburgh T.C. Installation in Clermiston North housing development.—See 29 Apr. issue.

21 May—Sunderland T.C. Electrical installation at Broadway primary junior school. Borough Architect, Grange Hse, Stockton Rd. Deposit £2. 2s.

22 May—Omagh U.D.C. Supply and erection of street lighting scheme at Omagh. John McGale, town clerk of Omagh U.D.C. Deposit £10. 10s.

24 May—Stourbridge T.C. Electrically and diesel driven vertical spindle centrifugal pumps at Enville St pumping station.—See 8 Apr. issue.

24 May—West Riding. Rewiring of (a) Ossett Flushdyke school; and (b) South Elmsall secondary modern school. County Architect, Bishopsgarth, Westfield Rd, Wakefield.

26 May—Durham. Installation in 144 houses at Acre Rigg.—See 15 Apr. issue.

27 May—N. Ireland. Electrical installation at Ballywalter meals kitchen, Co. Down. Educ. Committee, 1 Wellington Pl, Belfast. Deposit £3.

28 May—Belfast T.C. Lighting and heating installation at Power Station West.—Advertised in 29 Apr. issue.

28 May—Wortley R.D.C. Electrical installation in total of 317 houses at Mortomley, High Green, nr. Sheffield. A. Wikeley, Engineer and Surveyor, Council Offices, Grenoside, Sheffield. Deposit £2.

28 May—Southend-on-Sea. Electrical installation at Westcliff high school for boys, Eastwood Lane. Borough Architect, 30 Alexandra St. Deposit £2.—Advertised in this issue.

29 May—Mitcham T.C. Erection of 116 concrete columns with 100 W tungsten filament lamps and lanterns with wiring in group B along various roads. Borough Engineer and Surveyor, Town Hall.

31 May—Kilkenny T.C. Supply and installation of pumping plant comprising two vertical spindle sewage pumps and two a.c. electric motors and all accessories. E. R. Ryan, consulting engineer, 1 Montpelier Terr, Galway. Deposit £10. 10s.

31 May—Westmeath (Eire). Supply and erection of pumping plant comprising two sets combining centrifugal pump and electric motor with accessories, for Tyrrelpass water supply. P. H. McCarthy and Son, consulting engineers, 26 Lower Leeson St, Dublin. Deposit £5. 5s.

9 June—Maidstone T.C. Rewiring and replacement of electrical fittings in 70 houses on Cherry Orchard estate. Borough Surveyor, Palace Ave.

10 June—Belfast T.C. Extension to ash handling plant of high pressure sluicing type, at Power Station West. Form N.1427. Merz and McLellan, consulting

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 109 queries answered this week

Aneta irons, address for service? L.E.B.—Brun Electric Services, Bank Parade, Burnley.

"Heffer" fluorescent fittings, makers of? S.E.L.—E. Heffer and Co., Ltd., 17 Montpelier St, S.W.7.

"Uvral" massage equipment, makers of? R.J.—Buckleys (Uvral) Ltd., Beta Works, Riverside, S.W.15.

"Carefree" washing machines, makers of? E.M.E.B.—Carefree Domestic Appliances Ltd., 44/48 Adeline St, Manchester 4.

High-rated portable immersion heater for fonts in Baptist churches, makers of? S.E.B.—Heatrae Ltd., Heatrae Works, Norwich.

"JP" lawnmowers, makers of? S.E.L.—J.P. Eng. Co., Ltd., Meynell Rd, Leicester.

"Elco" soldering irons, suppliers of? L.G.A.—Elcordia Ltd., Luma Works, Sanatorium Rd, Cardiff.

"Eltex" poultry lamps, makers of? B.W.—G. H. Elt, Eltex Works, Bromyard Rd, Worcester.

ANSWER WANTED

"Marielco" protected plugs and sockets marked AP-2676, makers of? T.B.C.

engineers, Carliol Hse, Newcastle-on-Tyne. Deposit £5. 5s.—Advertised in this issue.

11 June—Portsmouth T.C. Supply and installation of electrically operated air conditioning and gas filtration plant at C.D. Main Control, Fort Widley. City Engineer, City Council Chambers, 1 Clarence Parade. Deposit £2.

No date stated—Merthyr Tydfil. Rewiring of Merthyr Labour Club. Details from Secretary of Club.

No date stated — Middlesbrough. Teesside Hospital Management Committee invite interested contractors to submit names for electrical works at hospitals. Names to S. G. Lightfoot, group secretary, N. Ormesby Hospital, Middlesbrough.

No date stated—Midlothian. Installation in block of six shops and three dwellings above at Danderhall and Poltonhall.—See 29 Apr. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

31 May—Australia. Supply of one 600 kW single steel cylinder pumpless rectifier with 3-phase transformer, all auxiliary equipment to provide complete converting unit without switchgear but with EETEE anode fuses. Contract 1762. Melbourne Tramways Board. B.o.T. (Ref.: ESB 10602/54).*

31 May—Australia. Melbourne Tramways Board invites tenders (No. 1761) for supply of 15 manually operated 6,600 V oil circuit-breakers. B.o.T. (Ref.: ESB 10530/54).*

31 May—Iraq. Directorate-General of Municipalities, Baghdad, require six 50 kVA transformers. Specifications from Directorate's Accountant. Deposit ID.150s. B.o.T. (Ref.: ESB 10542/54.)*

15 June—Egypt. Supply of radio transmitting equipment for station on Cairo-Alexandria desert road, and receiving apparatus for Maadi wireless station. State Telegraphs and Telephones Admin., Cairo. B.o.T. (Ref.: ESB 10550/54).*

22 June—New Zealand. State Hydro-Electric Department requires supply (Contract No. 255) of three 23,334 kVA 220/11 kV transformer banks and spare unit for Atiamuri power station. Documents available at N.Z. Government Offices in London.

9 July—India. Supply of line materials and erection of Singarappet-Villuputram single-circuit 110 kV transmission line (69 miles); and Singarappet-Vellore single-circuit 66 kV line; for Government of Madras Electricity Dept. Copies of specification E.220 available at Rs25s plus sales tax Rs 0-6-3. B.o.T. (Ref.: ESB 10652/54).*

16 July—Australia. Supply of four 11 kV, 3-phase, 600A, metalclad indoor type switchboards under tender No. E.13/54, for Brisbane City Council. Documents from Chief Engineer and Manager, Dept. of Electricity, Kelvin Hse, Adelaide St. at 10s. 6d. per copy. B.o.T. (Ref.: ESB 10379/54).*

27 July—New Zealand. Supply of 4-motor electric o.h. travelling crane at Atiamuri power station, required for handling turbine and generator parts during erection and maintenance, for Hydro-Electric Dept. Documents available at N.Z. Govt. offices in London. Amount of deposit £100, and of bond £800.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 4 May

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	243½	+5	253
,, (3 months)	237	—	—
LEAD, refined pig, min. 99·97% purity (cash)	93	−1½	80½
,, (3 months)	91	+2½	79⅝
TIN, refined, min. 99·75% purity (settlement)	712½	−37½	741½
,, (3 months)	712½	−32½	741½
ALUMINIUM, ingots 99-99·5%	156	—	161
ZINC, virgin, min. 98% purity (cash)	79½	−½	68⅝
,, (3 months)	79	−½	68⅝
RUBBER No. 1, RSS. spot (per lb)	18⅝d.	−1⅛d.	21⅛d.
,, c.i.f. basis, ports. July (per lb)	18⅛d.	−1⅜d.	21⅜d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52	—	51½
Mild Steel Tape (0·014 in.)	40½	—	40

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Mount Engineering Co., Ltd., Slater St, Oldham. To take over business of mechanical, electrical, textile and agricultural engineers and pump and diesel engine manufacturers carried on at Bartlemore St, Vale Mill, Oldham, and at Middleton Junction, Lancs, as "The Mount Engineering Co." Nom. cap.: £10,000. Dirs.: T. Brierley, Eva Brierley, D. S. N. Brierley, K. J. L. Brierley, B. Brierley and A. Courtley.

F. K. Smith Ltd., 92/4 Whitechapel, Liverpool. Electricians, electrical contractors and engineers, etc. Nom. cap.: £10,000. Dirs.: F. K. Smith and H. A. Smith.

Contracts Placed

B.E.A. High and low pressure pipework and valves at Brunswick Wharf, C. A. Parsons and Co., Ltd., and 132 kV, 66 kV, 33 kV and auxiliary cables at same, W. T. Glover and Co., Ltd.; 66 kV switchgear at Deptford East, Metropolitan-Vickers Electrical Co., Ltd.; 132 kV, 2,500 MVA switchgear at Goldington, A. Reyrolle and Co., Ltd.; Two 830,000 lb/hr boilers at Castle Donington, Babcock and Wilcox Ltd.; Ash and dust handling plant at Nottingham, B.V.C. Industrial Constructions Ltd.; Four circulating water pumps at Willington A, Drysdale and Co., Ltd.; 132 kV and auxiliary cables at Hams Hall C, W. T. Glover and Co., Ltd.; 132 kV switch house at Carmarthen Bay, Balfour Beatty and Co., Ltd.; 3,000 V and 415 V auxiliary switchgear at Connah's Quay, A. Reyrolle and Co., Ltd.; High and low pressure pipework at Keadby, C. A. Parsons and Co., Ltd.; four 180,000 lb/hr boilers at Clyde's Mill, Yarrow and Co., Ltd.; six 200,000 lb/hr boilers at Dalmarnock, Yarrow and Co., Ltd.; 132 kV, 2,500 MVA switchgear at Windscale, Metropolitan-Vickers Electrical Co., Ltd.; 132 kV and 66 kV connections and ancillary equipment at Hunshelf, A. Reyrolle and Co., Ltd.; two 15 MVA, 132/11 kV transformers and earthing transformers at Carlton Husthwaite, Bruce Peebles and Co., Ltd.; 132 kV o.h. line Spondon-Allerton-Winster, Balfour Beatty and Co., Ltd.; 132 kV. o.h. line from Drakelow to Burton power station, Balfour Beatty and Co., Ltd.; 132 kV o.h. line Creyke Beck to Driffield, Riley and Neate Ltd.; and 132 kV o.h. line at Rochdale, British Insulated Callender's Construction Co., Ltd.

Norman Bethell Ltd., 75 Cecil Av, Sale, Ches. To construct railways, tramways, gas and electricity works, waterworks, etc. Nom. cap.: £3,000. Permt. dirs.: R. C. N. Bethell and Ethel Bethell.

Lancasters Electricians (Brighton) Ltd., 29 Addison Rd, Hove. To take over business of electrical contractor carried on at Brighton by Victor Lancaster. Nom. cap.: £1,000. Permt. dirs.: V. Lancaster and R. Challice.

Precision Component Manufacturing Co. (Southern) Ltd., 306/310 High Rd, South Benfleet, Essex. Manufacturers of precision parts and components for electrical, electronic and scientific apparatus, aircraft and motor engines, etc. Nom. cap.: £5,000. Dirs.: K. P. Pearce, T. A. Gatrell, Iris E. Pearce and Margaret K. Gatrell.

L. J. Evans (Scientific) Ltd., 8 The Mall, Ealing, W.5. Scientific instrument makers, etc. Nom. cap.: £100. Dirs.: L. J. Evans and P. B. Black.

Gazette Announcements

COMPANIES ACTS

T. G. Brunskill Ltd. Resolution for voluntary winding-up passed at meeting on 14 Apr. D. R. B. Broom of 1 North Pl, Cheltenham, was appointed liquidator.

Refractories (South Wales) Ltd. Resolution for voluntary winding-up passed at meeting on 22 Apr. W. J. Pallot, inc. acc., 128 Bute St, Cardiff, was appointed liquidator, and creditors are asked to send particulars to him by 4 June.

Mead Electric Co. Ltd. Meeting of members will take place at 4 Buckingham Gate, London, S.W.1, on 28 May at 2.30 p.m., to receive liquidator's report.

John A. Grey and Partners. Last day for receiving proofs in respect of intended dividends. 14 May. Liquidator is C. H. S. Levis, 108a Cannon St, E.C.4.

Partnership Dissolved

Sundrown Neon. Partnership between Frederick C. Dillmutt and William G. Kerr, makers of neon signs, cold cathode lighting and electrical engineers, at 8 Ray St, London, E.C.1, dissolved as from 30 Nov. Debts received and paid by F. C. Dillmutt who will continue business.

BANKRUPTCY ACTS

Receiving Order

London. Christopher H. Sanders, electrician trading at 132 Florence Rd, Smethwick. Date of receiving order, 14 Apr.

BUSINESS PROSPECTS

Home

Airdrie T.C. Plans approved for erection of 134 houses on Burnfoot site.

Alloa. Donaldson Bros., Hallpark Mills, to erect knitwear factory on Alloa-Tullibody Rd.

Banstead (Sur.). Approval received for erection of primary school in Shawley Way. Cost estimated at £54,000.

Berwick. Gray and Paterson, 11 Castlegate, are architects for restaurant in Hide Hill next to King's Arms Hotel.

Birmingham T.C. Layout plans approved for 315 dwellings on Wyrley Birch estate, Perry Bar.

Bolton. Erection of Canon Slade school on The Oaks estate, Bradshaw. Architects are Taylor and Young of Manchester.

Boscombe (Hants.). Approval sought for erection of pathological laboratory at Royal Victoria Hospital. Cost estimated at £27,000.

Brighton T.C. Tenders invited for erection of factory at East Moulscomb industrial area. D. J. Howe, 26-30 King's Rd. Approval sought for erection of R.C. school for St. Joseph's, Hollingbury. Revised scheme prepared for erection of factory for Henry Clark and Sons Ltd. at Hollingbury light industrial area.

Campbeltown. A. Douglas Ltd., Ingram St, Glasgow, to erect clothing factory on Albyn Distillery site.

Chelmsford. Sketch plans approved for erection of Melbourne Park primary school. Cost estimated at £102,575.

Clevedon U.D.C. Construction of 20 houses in district. Engineer and Surveyor, The Council House.

Congleton T.C. Erection of 58 houses on Buglawton estate. C. Brown, Borough Engineer and Surveyor, Town Hall.

Dumfries. Dean of Guild Court has approved plans for 117 houses at Summerhill, estimated to cost £142,500.

Dunfermline T.C. Dean of Guild Court has approved plans for primary dept. at Pitcorthie school. Estimated cost £60,000.

Edinburgh. A. Reiach and R. Cowan, 30 Melville St, are joint architects for college of agriculture in West Mains Rd. for University Authorities. Cost estimated at £370,000.

Evesham T.C. Erection of 42 houses and 28 flats on Fairfield No. 7 site. Council's Architects, Pemberton and Bateman, 21 Vine St.

Grangemouth T.C. Dean of Guild Court has approved plans for erection of 231 houses in Beancross Neighbourhood Unit.

Greenock. Top flat of Municipal Buildings to be reconstructed for use as offices and lift installed at cost of about £23,000.

Harlow (Essex). Architect for second phase of factory proposed at new town by Kores Manufacturing Co., Ltd., is V. Hamnet, Terlings, Gilston, Essex.

Huyton-with-Roby (Lancs.) U.D.C. Erection of 11 shops with 18 flats in St. John's Rd East. Chief Architectural Assistant, Council Offices, Derby Rd.

Kendal T.C. Tenders may soon be invited for erection of 80 houses on Hall Garth estate.

Kettering T.C. During next two years it is proposed to build 334 houses and flats on new Pytchley Rd estate.

Kirkintilloch T.C. Dean of Guild Court has approved plans for 10 three-storey blocks containing 138 houses at Newdyke.

Leeds T.C. Expenditure of £2,500 approved on improved lighting in Civic Theatre. United Leeds Hospitals suggesting five-storey extension to General Infirmary. Cost estimated at £175,000.

Newcastle-on-Tyne T.C. Construction of 68 flats and maisonnettes in five storeys on Elswick St site. City Architect, 18 Cloth Market.

North Riding. Tenders to be obtained for erection of Eastfield No. 3 county primary school, Scarborough. Quantity surveyors are Davies, Belfield and Everest, 9 Ashley Pl, Westminster.

N. Ireland. Erection of 46 houses at Drumahoe, Larne. R.D.C. Offices, Larne.

Redcar (Yorks). Thompson's Enterprises Ltd., Palladium Buildings, Middlesbrough, to rebuild Central Cinema.

Sutton (Sur.). Erection of £108,000 secondary school at Sutton Common.

Taunton (Som.) T.C. Approval received for layout plans for about 800 houses, two nursery schools, an infants' and junior school, two churches and shops at Lyngford during this year.

Tynemouth T.C. £750,000 scheme in hand for construction of multi-storeyed flats at North Shields. Architects will be A. K. Tasker and A. Child, Trinity Buildings, New Bridge St, Newcastle-on-Tyne.

West Hartlepool. Work to begin next year on Brierton secondary school and St. Teresa's R.C. junior and infant school.

Overseas

Colombia. Cia. Importadora de Repuestos y Accesorios para Automotores "Cideral," J. P. Bohorquez and Cia, Apartado Aereo 586, Barranquilla, Rep. Colombia, are enquiring for small diesel generating sets from 1 to 15 kW.

TRADE NOTES

Internal Reorganisation. In pursuance of the plan to consolidate the activities of the Parkinson and Cowan group of companies, the Electrical Division of Measurement Ltd. is being transferred at the end of this month to Parkinson and Cowan Ltd., the parent company. On the same date Aspec (London) Ltd. will be liquidated and will cease to trade as a separate limited company. As from 1 May, the Electrical Division and Aspec will be merged and will operate as a new division of Parkinson and Cowan Ltd., under the title "Parkinson and Cowan Instruments (Incorporating Aspec) a Division of Parkinson and Cowan, Ltd."

London office. Edward Wilcox and Co., Ltd., have opened a new London office under their own name at Fulwood Hse, Fulwood Pl, W.C.1. Telephone Chancery 2206. This office now has no connection with the agency which previously operated on Wilcox's behalf.

Catalogues. Mortimer, Gall and Co., Ltd., are reorganising their library of catalogues, and invite manufacturers to send current literature to them at 115/177 Cannon St, London, E.C.4.

Motors. The Australian Department of Trade and Customs has decided that 5 h.p. single-phase repulsion induction (commutator type) electric motors are subject to a British Preferential duty of 22½% ad valorem.

Changes of address. The Glasgow sales office of Brook Motors Ltd. has this week moved to Carlton Hse, Blythswood Sq, Glasgow, C.2. Telephone Central 1045.

As from 1 June the postal address of the Sheffield premises of W. Canning and Co., Ltd., will be 1 the South Parade, Shalesmoor, Sheffield 3. The telephone no. remains Sheffield 24101.

The Leeds office of A. Reyrolle and Co., Ltd., has this week moved from Park Row to 20/22 St. Paul's St, Leeds 1. The telephone number remains Leeds 21521. As previously, the joint North Midland and Leeds area office is under the control of the manager Mr A. J. Coveney, M.I.E.E.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Pye. B719,323 Class 9 and B719,324 Class 11. Domestic electrical appliances. Pye Ltd., Radio Works, St Andrews Rd, Cambridge.

VCS in design. B726,419. Class 9. Electric suction cleaners and parts. Vacuum Cleaners and Supplies Ltd., 20/22 Gypsy Hill, S.E.19.

Delfin in design. 726,301. Class 7. Machines for washing, draining, drying and ironing, etc. Claudio Carbonell, Calle Jaime Piquet No. 22, Barcelona, Spain.

Barralets in design. 726,977. Class 11. Heating apparatus, apparatus for sterilising food containers and heated clothes drying cubicles and cupboards. Barralets Engineering Co. Ltd., 58 Lee Church St, S.E.13.

MEETINGS TO NOTE

THURSDAY, 6 MAY

I.E.E. (London).—"Electric Traction using Single-phase 50 c/s Current." M. Garrean: "Electric Locomotives on Valenciennes-Thionville Line." F. Nouvion. Savoy Place, W.C.2. 5.30 p.m.

I.E.E. (S.W. Scotland).—Faraday lecture on "Electro Heat and Prosperity," O. W. Humphreys. Royal Tech. College, Glasgow, 7 p.m.

BRIT. INSTN. OF RADIO ENGINEERS (Merseyside).—Annual meeting and technical film show. Elect. Offices, Whitechapel, Liverpool, 7 p.m.

TUESDAY, 11 MAY

I.E.E. (London Measurements).—"Measurement as Factor in Understanding," K. J. R. Wilkinson, Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N. Ireland).—Annual meeting at Presbyterian Hostel, Howard St, Belfast, 6.15 p.m.

I.E.S. (Liverpool). — Annual meeting. "Traffic Signals," T. F. Priest. Elect. Offices, Whitechapel, 6 p.m.

THURSDAY, 13 MAY

I.E.E. (London Utilisation).—"Fuel Supplies of Future," D. Hicks. Savoy Place, W.C.2, 5.30 p.m.

I.E.S. (Nottingham).—Annual meeting.

FRIDAY, 14 MAY

INSTN. OF MECHANICAL ENGRS.—"Rapid Starting Technique: Significant Tests at Poole Power Station," J. S. Hall and A. F. Brittin. Birdcage Walk, Westminster, 5.30 p.m.

ELECT. TRADES' COMMERCIAL TRAVELLERS' ASSOC.—General meeting at Feathers Hotel, Broadway, Westminster, 6 p.m.

Overhead Service Accessories

60 AMP

Two additional Service Fuses for outdoor use are now available, one for maximum continuous working current up to 60 amp and the other up to 200 amp, both being suitable for Cartridge Fuse-links. The design is based on that of the well-known HENLEY 100 amp Outdoor Service Fuses but arranged to accommodate Cartridge Fuse-links.

HENLEY Outdoor Service Fuses

200 AMP

CARTRIDGE TYPE

Suitable for mounting on walls, on poles or with shackle type insulators.

Please ask for Folder 47/A.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD. 51-53 HATTON GARDEN, LONDON, E.C.1

PHILIPS

Pioneers of
Sodium Lamps
are helping to make British roads safer after dark

RIGHT from the start Philips have pioneered Sodium Lamps—now used so extensively for public lighting, floodlighting and some types of industrial lighting. These Philips Sodium Lamps give up to five times more light than ordinary lamps of similar consumption, providing increased visual acuity, enhanced contrasts and reduced glare.

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LAMPS • LIGHTING • RADIO • TELEVISION • 'PHILISHAVE' DRY SHAVERS
RECORD PLAYING EQUIPMENT • GRAMOPHONE RECORDS
'PHOTOFLUX' FLASHBULBS • ETC.

(LD489)

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

COUNTY COUNCIL OF THE WEST RIDING OF YORKSHIRE

TENDERS are invited for the complete re-wiring of the existing electrical installation to be carried out during the summer holidays, 23 July to 6 Sept., at the Conisborough Northcliffe Rd Secondary School.

Specification with plans, together with Conditions of Tender, may be obtained on application to the County Architect, Bishopgarth, Westfield Rd, Wakefield, on payment of a deposit of £2. 2s. which will be returned on receipt of a bona-fide tender. Cheques must be made payable to the West Riding Treasurer and crossed "and Co."

Sealed tenders must be addressed to me, the undersigned, and received at Room 3, County Hall, Wakefield, not later than 10 a.m. on Monday, 17 May, 1954.

BERNARD KENYON,
Clerk of the County Council.
(H 617)

COUNTY BOROUGH OF SOUTHEND-ON-SEA
Electrical Installation

TENDERS are invited for the New Electrical Installation at Westcliff High School for Boys, Eastwood Lane.

General Conditions may be inspected and copies of Form of Tender, Plans, and Specification obtained on application to the Borough Architect, 30 Alexandra St, on payment of a deposit of £2 which will be refunded on receipt of a bona fide tender or the return of all loaned documents.

Sealed tenders addressed to the undersigned and endorsed "Westcliff High School for Boys—Electrical Installation" are to be delivered to this office before 12 noon on Friday, 28 May, 1954.

No tender will be received except in the special envelope provided, which shall not bear any name or mark indicating the sender.

The Corporation do not bind themselves to accept the lowest or any tender.

ARCHIBALD GLEN,
Town Clerk.
(H 654)

CITY AND COUNTY BOROUGH OF BELFAST
Electricity Department
ELECTRICITY (ESSENTIAL SUPPLIES) ACT (NORTHERN IRELAND) 1954

TENDERS are invited for the Supply, Delivery and Erection at the First Extension of Belfast Municipal Electric Power Station West of:

Extension to Ash Handling Plant of the High Pressure Sluicing Type, capable of removing 40 tons of ash per hour from furnace hoppers and delivering to ash storage bunkers. The equipment represents additional units required to operate with existing plant as an integral unit and the pumps, pipework and sluiceways shall be designed to match up with the existing installation and fit in with provision made to accommodate this extension.

Form of Tender (N.1427), Conditions,

continued in next column

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Specification, and Drawings, in quintuplicate, may be obtained from Messrs Merz and McLellan, Consulting Engineers, Carliol House, Newcastle upon Tyne 1, on payment of a deposit of Five Guineas, which will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the tender document may be obtained at One Guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in quadruplicate, in sealed envelope marked "Tender for Ash Handling Plant, Electricity Department" and endorsed with the name and address of the tenderer, must be addressed to the Town Clerk, City Hall, Belfast, so as to reach him not later than 4 p.m. on Thursday, 10 June, 1954.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

EYRE GORDON,
Chairman,
East Bridge St, Belfast. Northern Ireland Joint Electricity Committee.
(H 653)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

BRITISH ELECTRICITY AUTHORITY
South Wales Division

APPLICATIONS invited for following superannuable N.J.B. appointments:

Vacancy No. 38
ENGINEERING DRAUGHTSMEN

Generation (Construction) Department, Divisional Headquarters. Salary D.6 (£433/£567 per annum).

Knowledge of mechanical and/or electrical installations and plant layout. H.N.C. or equivalent desirable.

Vacancy No. 39
JUNIOR ENGINEERS

At various South Wales Power Stations. Minimum commencing salary £402 per annum, with scope for advancement to higher operation/maintenance posts. H.N.C. and previous manufacturing works training essential.

Vacancy No. 42
STATION SHIFT CONTROL ENGINEER

Tir John Power Station, Swansea. Salary H.10 (£641/£667 per annum). H.N.C. and experience in Control Room of modern Power Station required.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 17 May, 1954. (H 630)

YORKSHIRE ELECTRICITY BOARD
No. 5 (Wakefield) Sub-Area
SECOND ASSISTANT ENGINEER
(Service Centres, Publicity and Appliance Sales)

APPLICANTS must have had considerable experience in the organisation and supervision of Service Centres within the Electricity Supply Industry and in development work including publicity, the purchasing and sale of electrical appliances, hire-purchase negotiations, the organisation of lectures, demonstrations, window and other displays, including agricultural shows, and advising consumers on the use of electricity. The successful applicant will be responsible to the Sub-Area Commercial Officer for the general supervision and organisation of all the Service Centres within the Sub-Area.

Salary—N.J.B. Class K, Grade 7, £869/£907 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 20 May, 1954.

No. 3 (Sheffield) Sub-Area
GENERAL ASSISTANT ENGINEERS
(Construction and Maintenance)
(Two Posts)

Applicants should hold the Higher National Certificate in Electrical Engineering and should have had experience on electrical distribution, preferably on overhead line systems up to 66 kV and/or on underground cable systems up to 33 kV. Both mains and substation experience is desirable.

The candidate appointed to post (a) will be recognised as the Senior of the General Assistant Engineers at the Depot in the absence of the Third Assistant Engineer.

Salary:

(a) N.J.B. Class N, Grade 12, £744/£766 per annum, and

(b) N.J.B. Class N, Grade 13, £692/£716 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield, not later than 20 May, 1954.

No. 4 (Leeds) Sub-Area
Leeds District
ASSISTANT CONSUMERS' ENGINEER

Applicants should have had a sound training and subsequent experience in the work of a Consumers' Engineer Department.

Details should be given of experience in the following matters:

Negotiations with consumers requiring electricity supplies, tariffs, sales development, application of I.E.E. Wiring Regulations and other relevant regulations in testing and inspecting consumers' installations, electrical installation work. Control of staff and workpeople.

Salary—N.J.B. Class J, Grade 12, £596/£619 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than 20 May, 1954.
(H 621)

MIDLANDS ELECTRICITY BOARD

JUNIOR ENGINEER required in the Commercial Department of the Central Gloucestershire Sub-Area. Previous experience in commercial or distribution activities an advantage. Technical qualifications desirable. Salary £424 per annum (N.J.B. Grade H.16) Superannuable.

Apply, in writing, within 14 days, stating age, experience, present salary and position to Mr D. Holt, Sub-Area Manager, Midlands Electricity Board, 126 London Rd, Gloucester.

A. STEPHENS,
Secretary.
(H 629)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

ENGINEERING DRAUGHTSMEN (CIVIL)
Construction Department
Vacancy No. 1/54/ET

Candidates should have experience in design and detail of reinforced concrete structures, piled and slab foundations for heavy plant, culverts, cable subways, etc., for general building construction drainage and sanitation schemes, associated with official and administrative buildings.

The salary will be in accordance with Grade 5 (£567/£671 per annum) or Grade 6 (£433/£567 per annum) of Schedule D of the National Joint Board Agreement.

ENGINEERING DRAUGHTSMEN (MECHANICAL)
Construction Department
Vacancy No. 2/54/ET

Senior Draughtsmen are required in the Mechanical Section of the Construction Department at North Wilford Power Station. Candidates should have experience in one or more of the following:

(i) Design and layout of Power Station equipment, including turbo-alternators, boiler plant, coal and ash plant, and general station auxiliaries.
(ii) H.P. and L.P. steam and feed pipework. Condensing plant and feed heating systems.
(iii) Conveyor plant, coal handling systems and material handling of station auxiliary equipment.

The salary will be in accordance with the National Joint Board Agreement, Grade 5 (£567/£671 per annum) and Grade 6 (£433/£567 per annum) of Schedule D according to experience.

ENGINEERING DRAUGHTSMEN (ELECTRICAL)
Construction Department
Vacancy No. 3/54/ET

Candidates should have experience in the preparation of layouts and diagrams for the installation of E.H.T. and L.T. switchgear, transformers, E.H.T. and L.T. cables: knowledge of protective gear systems would be an advantage.

The salary will be in accordance with the National Joint Board Agreement Grade 5 (£567/£671 per annum) and Grade 6 (£433/£567 per annum) of Schedule D according to experience.

SHIFT CHARGE ENGINEER
Warwick Power Station
Vacancy No. 64/54/ET

Applicants should have experience in a responsible position of Power Station operation and be suitably qualified.

Salary in accordance with Class E, Grade 7 (£649/£681 per annum) of the National Joint Board Agreement.

The closing date for receipt of applications is 17 May, 1954.

DRAUGHTSMEN
Transmission Department
Vacancy No. 46/54/ET

Draughtsmen are required in the Transmission Department at this Divisional Headquarters. Experience on the design and construction of H.V. substations or overhead transmission lines an advantage.

Salary, according to experience and ability, within Grade 6 (£433/£567 per annum) or Grade 5 (£567/£671 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications is 17 May, 1954.

TWO—SECOND ASSISTANT ENGINEERS (MECHANICAL)
Generation (Construction) Department
Vacancy No. 69/54/ET

Preference will be given to applicants who hold a degree in Mechanical Engineering, are Corporate Members of the Institution of Mechanical Engineers, or possess equivalent qualifications. Some electrical training and experience will be a recommendation.

They should be experienced in the design and construction of turbo-alternators, boilers, coal and ash handling plant, high pressure steam and water piping and other ancillary work.

Experience in the preparation of specifi-

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cations and estimates and a knowledge of thermo-dynamics and hydraulics will be an advantage.

Salary will be within Schedule C, Class AX/DX, Grade 2 (£834/£1,053 per annum) of the National Joint Board Agreement.

The closing date for receipt of applications is 24 May, 1954.

TWO—THIRD ASSISTANT ENGINEERS (ELECTRICAL)
Generation (Construction) Department
Vacancy No. 70/54/ET

Applicants should have a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection, maintenance and operation of switchgear transformers, electrical auxiliaries, main and multicore cable work, and lighting and heating installations for large power stations. Preference will be given to candidates who possess a university degree or equivalent qualification in electrical engineering.

Salary will be within Schedule C, Class AX/DX, Grade 5 (£649/£858 per annum) of the National Joint Board Agreement.

The closing date for receipt of applications is 24 May, 1954.

TWO—THIRD ASSISTANT ENGINEERS (MECHANICAL)
Generation (Construction) Department
Vacancy No. 71/54/ET

Applicants should have a fundamental training in mechanical engineering, including workshops, and should preferably have had experience in the manufacture, erection, maintenance and operation of mechanical plant as installed in modern power stations. Preference will be given to candidates who possess a university degree or equivalent qualification in Mechanical Engineering.

Salary will be within Schedule C, Class AX/DX, Grade 5 (£649/£858 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications is 24 May, 1954.

THREE—GENERAL ASSISTANT ENGINEERS
Generation (Construction) Department
Vacancy No. 72/54/ET

Preference will be given to applicants who hold the Higher National Certificate in Electrical or Mechanical Engineering, are Graduate Members of the I.E.E. or I.MECH.E., and who have had workshop training.

Salary will be within Schedule C, Class AX/DX, Grade 8 (£501/£694 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications is 24 May, 1954.

The above positions will be pensionable within the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box No. 25, British Electricity House, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
(H 641)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of SECOND DEVELOPMENT ASSISTANT (Industrial) in the Commercial Department of the Board's No. 1 Sub-Area, based on Liverpool. Salary N.J.B. Grade 7, Class L (£926/£966 per annum).

Candidates should have the technical qualifications necessary to enable them to become Chartered Electrical Engineers, have had wide experience in the industrial application of electricity, and be capable of advising on and estimating for the provision of supply to all classes of industry.

The appointment is superannuable and subject to medical examination.

Applications, on special forms obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3, should be submitted not later than 19 May, 1954. (H 624)

LONDON ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for the above position in the Drawing Office of the North Eastern Sub-Area.

Candidates should have had a good general and technical education and be experienced in one or more of the following: engineering drawings; plant layout in substations; layouts and site plans of mains work; electrical diagrams.

The post is graded under Schedule "D" of the National Joint Board Agreement as Grade 6—£458 to £595. 7s. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2. Please enclose addressed envelope and quote ref. V/1735/T on envelope and all correspondence. (H 638)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.MECH.E. for posts (a) and Corporate Membership for post (b) an advantage.

(a) JUNIOR ENGINEER
BARKING "C" GENERATING STATION
Vacancy No. 54/322

Practical experience of Power Station plant required for the general duties in Station. Applicants must be prepared to carry out shift duties if required. Salary within Class J, Grade 18/4=£427/£572. 5s. p.a.

(a) STATION SHIFT CONTROL ENGINEER
BARNES GENERATING STATION
Vacancy No. 54/323

Candidates should have a good general education and technical training, and previous experience in the operation and control of E.H.T. switchgear is essential together with a knowledge of D.C. and A.C. L.T. distribution and rotary convertors. Salary—Class C, Grade 10=£527. 2s. p.a.

(b) ASSISTANT TURBINE HOUSE SUPERINTENDENT
BATTERSEA GENERATING STATION
Vacancy No. 54/324

Qualifications: Sound engineering training followed by considerable experience on the operation and maintenance of Modern High Pressure Turbine Plant and E.H.T. Switchgear. Salary—Class M, Grade 7=£1,035. 6s. p.a.

(a) JUNIOR ENGINEER
BOW GENERATING STATION
Vacancy No. 54/325

Practical experience of Power Station plant required for the general duties in Station. Salary—Class F, Grade 14=£476 p.a.

(a) SHIFT CHARGE ENGINEER
LOMBARD ROAD GENERATING STATION
Vacancy No. 54/326

Sound technical education necessary with experience in operation of Boiler House and Turbine Room Plant. Salary—Class F, Grade 7=£731. 17s. p.a.

(a) STATION SHIFT CONTROL ENGINEER
WIMBLEDON GENERATING STATION
Vacancy No. 54/327

Candidates should have a good general education and technical training, and previous experience in the operation and control of E.H.T. switchgear is essential together with a knowledge of D.C. and A.C. L.T. distribution. Salary—Class E, Grade 10=£582. 15s. p.a.

(a) GENERAL ASSISTANT ENGINEER
TRANSMISSION DEPARTMENT
DIVISIONAL HEADQUARTERS
Vacancy No. 54/328

Experience necessary in the operation and maintenance of a high voltage transmission system or a Works training on high voltage switchgear and transformers. Salary—Class AX/EX, Grade 8=£526. 1s./£749. 14s. p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (H 643)

THE SOUTH WEST SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the undernoted appointments in the Chief Engineer's Department:

(1) ASSISTANT CHIEF ENGINEER
(Operation and Maintenance)

Applicants should have extensive experience in the operation and maintenance of large networks, both underground and overhead at 415 V, 11 kV, and 33 kV and of protective gear. Experience in the control of engineering staff and in the organisation of extensive electricity supply undertakings will be considered an advantage.

Salary—N.J.M.C., Scale 2—£1,300/£1,450 per annum.

(2) SENIOR ASSISTANT ENGINEER
(Construction)

Applicants should, preferably, be corporate members of one of the senior engineering institutions. Considerable experience in the design and construction of substations up to 33 kV both indoor and outdoor, the erection of overhead lines and the laying and jointing of cables up to 33 kV is essential. Some knowledge of the progressing of construction contracts would be advantageous.

Salary—N.J.B., Schedule C, AX/DX1—£970/£1,198 per annum.

(3) SECOND ASSISTANT ENGINEER
(Planning and Development)

Applicants should have had works experience of manufacture and design of distribution plant, and of the design, construction and operation of distribution systems up to 33 kV. A specialised knowledge of one of the branches of system design, such as overhead lines, cables, substations, switchgear and transformers and also of the economic problems of distribution or statistical treatment of problems, would be an advantage.

Salary—N.J.B., Schedule C, AX/DX2—£834/£1,053 per annum.

(4) THIRD ASSISTANT ENGINEER
(Planning and Development)
(2 appointments)

Applicants should have had works experience of manufacture and design of distribution plant, and, preferably, have had some experience of the design, construction and operation of a 33 kV distribution system. A specialised knowledge of some branch of distribution engineering would be an advantage.

Salary—N.J.B., Schedule C, AX/DX5—£649/£858 per annum.

The appointments will be superannuable. Applicants for appointments (1), (3) and (4) should, preferably, possess a degree or equivalent qualification in Electrical Engineering and be Corporate Members of the Institution of Electrical Engineers.

Forms of application may be obtained from the applicant's appropriate Officer or the undersigned and should be returned to the undersigned not later than Saturday, 22 May, 1954.

J. MEEK,
Secretary.

62 Dalziel Drive,
Glasgow S.1. (H 604)

BRITISH ELECTRICITY AUTHORITY
South West Scotland Division

GENERAL ASSISTANT ENGINEER (SECTION)

APPLICATIONS are invited for the position of a General Assistant Engineer (Section) in the Transmission Department, South-West Scotland Division, based at Kilmarnock. Applicants should have received a first-class technical education. Experience in maintenance and operation of high voltage overhead lines and outdoor transformers and switching stations would be an advantage. The salary will be within Grade 8, Class AX/CX, Schedule C of the National Joint Board Agreement.

Applications on Form AE6 which may be obtainable from Divisional Headquarters, 168, Broomhill Drive, Glasgow, W.1, or from any Divisional Office of the Authority should be returned to the Divisional Secretary by 24 May, 1954.

A. CHRISTIANSON,
Divisional Secretary.

29 Apr., 1954. (H 646)

SOUTHERN RHODESIA ELECTRICITY SUPPLY COMMISSION

VACANCY: TECHNICAL ASSISTANT

APPLICATIONS are invited for the above vacancy which exists in the Commission's Concession District, and the duties will be those of assistant to the District Engineer. Graduate I.E.E. or equivalent qualification is essential. The appropriate salary scale is £605 by six increments to £964 per annum upon which a Cost of Living Allowance of approximately 7½% is paid at present. The point of entry into the scale will depend on experience and ability. A house is available at a rental of 12½% of basic salary.

Cabin Class steamship passages and first class rail fares from the coast will be paid, but must be refunded to the Commission if the successful applicant resigns within three years. The appointment will be subject to a probationary period of three months and a satisfactory medical certificate. A child allowance is paid and membership of the Pension Fund and Medical Aid Society is compulsory.

Selected applicants will be called for interview in the United Kingdom when full details of the conditions of service and duties involved will be explained.

Applications must be addressed to the Official Secretary, Rhodesia House, 429 Strand, London, W.C.2, and the envelope marked "Staff Vacancy—Electricity Supply Commission," so as to arrive not later than 28 May. (H 520)

TRINIDAD AND TOBAGO ELECTRICITY COMMISSION

TRINIDAD and Tobago Electricity Commission requires an ADMINISTRATIVE AND PERSONNEL OFFICER. The yearly salary is £1,265 rising by increments of £27. 10s. to £1,347. 10s. When the Commission sells over 100 million units annually the salary will be £1,375, rising by increments of £27. 10s. to £1,457. 10s. A cost of living allowance of £25 and a house allowance—maximum £10. 8s. 4d. per month if married and £6. 5s. per month if single—are also payable. An outfit allowance of £60 will be granted on arrival.

Applicants must have successfully held responsible positions in Personnel Departments, in large or medium-sized organisations, and preferably be holders of a British University Degree and/or be members of the Institute of Personnel Management. Experience of T.W.I. an additional advantage.

The successful applicant will be provided with First Class passages for himself, his wife and two children up to the age of 18, on appointment. Leave passages to the United Kingdom or equivalent will be provided every three years. Vacation, casual and sick leave on full pay. The successful applicant will be requested to pass a medical examination.

General details of Trinidad's climate, income tax, etc., can be obtained from the West India Committee at 40 Norfolk St, London, W.C.2. Applications giving full details of qualifications, experience and personal particulars, together with two recent references, should be sent by Air Mail to reach the Acting General Manager, Trinidad and Tobago Electricity Commission, P.O. Box 121, Port-of-Spain, Trinidad, B.W.I., on or before 22 June, 1954. (H 606)

BRITISH ELECTRICITY AUTHORITY
South Western Division

STATION CHEMIST required at East Yelland Generating Station.

Superannuation Scheme. Salary N.J.B. Class "G," Grade 7, £729/£758 (Ultimate Classification Class "H").

Applicants should be experienced in Fuel, Oil, and Water testing. Familiar with and capable of taking part in investigations and carrying out performance tests. Recognised degree in Chemistry required.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Rd, Bristol, 8, should be completed and returned by 18 May, 1954. (H 622)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED GENERAL ASSISTANT ENGINEERS (Mains) at (1) District 225 (Ammanford) and (2) District 226 (Llanelly) in the West Central Sub-Area.

Salary for positions will be (1) Class D Grade 12 (£463/£470/£476) and (2) Class F, Grade 12 (£507/£516/£525) of N.J.B. Schedule.

Applications stating preference and giving age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 15 May, 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. (H 637)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

ASSISTANT ENGINEER is required at Nechells "B" Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule "A," Grade J12, commencing at £596 per annum.

A sound general education and technical training with power station experience is required. Appropriate technical qualifications an advantage.

Apply quoting Vacancy No. 657 MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 22 May, 1954. (H 639)

BRITISH ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for the following positions:

S/13.519
ENGINEERING DRAUGHTSMEN
(Mechanical) Construction Department

Applicants should have had experience of work concerning turbines and auxiliaries, boilers and auxiliaries, coal and ash handling plant and pipework.

S/13.520
ENGINEERING DRAUGHTSMEN
(Electrical) Construction Department

Applicants should have had experience of the layout of switchgear, cables and lighting in connection with power station construction. Experience in schematic diagrams an advantage.

Candidates should have a good technical education in mechanical or electrical engineering.

Salary N.J.B. Schedule D, Grade 5 (£567/£671) or Grade 6 (£433/£567) according to qualifications and experience.

S/13.518
WAYLEAVE OFFICER

Applicants should be of good education, and experience of negotiating with landowners and public and other authorities to arrange wayleaves in connection with overhead transmission lines, including settlement of claims for damage to crops, etc. Some knowledge of timber valuation and estate management, and of office organisation is desirable. Candidates should be car drivers.

Salary N.J.C. Grade 4, £605/£665.

Special application forms for the above posts, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 19 May, 1954. (H 631)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN required in the Engineering Department, Electricity House, Rhostyllen, near Wrexham. Salary within the range of £433 to £567 per annum, N.J.B. Schedule D, Grade 6.

Candidates should be experienced in one or more of the following subjects: Building and Civil Engineering Design; Engineering Drawing; Structural Steelwork Design; Overhead Line Design.

Possession of the H.N.C. advantageous.

The appointment is superannuable and subject to medical examination. Standard application forms obtainable from the Manager, above address. Closing date, 17 May, 1954. (H 623)

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER
Reigate District

SALARY £633/£643 under N.J.B. Schedule, Class D, Grade 7. Superannuable. Applicants should hold the Higher National Certificate in Electrical Engineering and should have had training and experience of underground systems up to 11 kV. Experience in overhead systems an advantage. The position will entail standby duties.

Application forms obtainable from C. Rowbotham, M.I.E.E., District Manager, SEEBoard, 8 Linkfield Corner, Redhill, to be returned giving 2 referees by 19 May, 1954.

4TH ASSISTANT DISTRICT ENGINEER
Worthing District

Salary £524 per annum under N.J.B. Agreement, Class E, Grade 11. Superannuable. Applicants should be suitably qualified and have had training and experience in the construction, operation, and maintenance of underground and overhead distribution systems preferably up to 33 kV.

Applications, naming 2 referees, must reach M. J. Mortimer, M.I.E.E., District Manager, SEEBoard, 56 Chapel Rd, Worthing, by 19 May, 1954.

DEMONSTRATOR (FEMALE)
Lewes District

Salary £400 by £20—£480 by £10—£490 p.a. under N.J.C. Grade 1. Superannuable. The person appointed will be required to conduct lectures and demonstrations, advise consumers and generally assist in showrooms. Preference to applicants in possession of recognised diploma or certificate in domestic science and the E.A.W. certificate.

Application forms, obtainable from G. R. Lincoln, A.I.E.E., District Manager, SEEBoard, 80 High St, Lewes, by 19 May, 1954.

A. L. BURNELL,
Secretary.
(H 645)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF JUNIOR ENGINEERS, SUB-AREA MAINS ENGINEER'S DEPARTMENT, MANCHESTER

APPLICANTS should possess the H.N.C. in Electrical Engineering or an equivalent qualification and should have had a basic works training of not less than two years. Successful candidates will be required to work in Manchester and surrounding districts and will be given the opportunity to gain experience in various sections of the Mains Engineer's Department.

Salary Scale: £402/£547 p.a. Grades M.21/17. N.J.B. Conditions.

APPOINTMENT OF JUNIOR ENGINEER (POWER SALES) SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, MANCHESTER

Applications are invited from young electrical engineers (preferably qualified or training for O.N.C. or H.N.C.) who could be trained specifically for power sales development. Previous experience in an electrical manufacturing firm and some knowledge of building heating problems will be an advantage.

Salary Scale: £449/£547 p.a. Grades M.19/17. N.J.B. Conditions.

Applications for above posts to the Sub-Area Secretary, No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493 by 15 May, 1954.

APPOINTMENT OF GENERAL ASSISTANT ENGINEERS (SYSTEM PLANNING AND DEVELOPMENT), SUB-AREA TECHNICAL ENGINEER'S DEPARTMENT, BOLTON

Candidates should have had a sound training in Electrical Engineering and be competent to assist in the preparation of schemes and estimates for extensions to the H.V. and L.V. systems up to 33 kV, and in the design and layout of substations. Preference given to candidates with experience of protective gear systems and an aptitude for system calculations.

Salary Scale: £616/£646 p.a. Grade L.13. N.J.B. Conditions.

The successful applicant will be required to work at Westhoughton for a period after appointment.

Applications to Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, National Buildings, St. Mary's Par-

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sonage, Manchester 3, by 15 May, 1954.

APPOINTMENT OF SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER (SERVICE ENGINEER)—STALYBRIDGE DISTRICT

Applicants must be experienced in the installation and maintenance of all types of domestic and commercial electrical appliances and in modern workshop practice and be capable of organising and supervising and workshop staff, including routine testing and maintenance work on consumers' premises.

Salary Scale: £729/£758 p.a. Grade G.7. N.J.B. Conditions.

APPOINTMENT OF SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER (SALES SUPERINTENDENT), ROCHDALE DISTRICT

The successful applicant will be required to assist the District Commercial Engineer in all sales and load development activities. He will be responsible for supervising service centres, and the work of outdoor and indoor sales personnel. The possession of an O.N.C. in Electrical Engineering would be an advantage.

Salary Scale: £697/£718 p.a. Grade F.7. N.J.B. Conditions.

Applications for above posts to Sub-Area Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, by 15 May, 1954.

APPOINTMENT OF SENIOR SALES REPRESENTATIVE, PRESTON DISTRICT

Duties will include general assistance in all activities connected with the utilisation of electricity for domestic, commercial, agricultural and industrial purposes.

Salary Scale: £485/£545 p.a. Grade 2, N.J.C. Conditions.

APPOINTMENT OF SENIOR SERVICE CENTRE ASSISTANT—LANCASTER

Experience in the sale of electrical equipment is essential and the possession of the E.D.A. Salesmanship Certificate will be an advantage. The person appointed will be required to supervise staff and take charge.

Salary Scale: £485/£545 p.a. Grade 2, N.J.C. Conditions.

Applications for above posts to Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune St, Preston, by 15 May, 1954. (H 614)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the positions of:

(1) POWER STATION SUPERINTENDENT
Tilbury Generating Station, Essex

(2) DEPUTY POWER STATION SUPERINTENDENT

Commencing salary for (1) will be Class J, Grade 1, of the N.J.B. Agreement, eventually rising to Class L, plus London Allowance.

Commencing salary for (2) will be Class J, Grade 3, of the N.J.B. Agreement, eventually rising to Class L, plus London Allowance.

This Station, which is at present under construction, is of the unit type and will comprise six sets of 60 MW capacity, steam conditions being 900 lb, p.s.i., 900° F, and will eventually be connected to the 275 kV Grid.

Applicants will be required to reside within a reasonable distance of the Power Station.

It will be of advantage if applicants have had experience in management, administration, joint consultation and labour relations, together with a knowledge of the commissioning, operation, maintenance and testing of plant in a generating station.

The boiler plant, which is of the water tube type, will be fired with pulverised fuel. There will be centralised control and high voltage electrical equipment.

Membership of a recognised Engineering Institution is desirable.

Application forms, which should be returned by 25 May, 1954, can be obtained from the Controller, Northmet House, Southgate, N.14.

W. N. C. CLINCH,
Controller.
(H 605)

BRITISH ELECTRICITY AUTHORITY

GENERATION Design Branch, Headquarters, require A GENERAL ASSISTANT ENGINEER to assist in the investigation and co-ordination of proposals for the general design and layout of the Authority's power stations. Candidates, preferably with an engineering degree or the necessary qualifications for corporate membership of the I.E.E. or I.MECH.E., should have some practical experience in the power station field. Salary N.J.B. Grade 5, £558/£769 inclusive.

Forms from D. Moffat, Director of Establishments, British Electricity Authority, Winsley St, London, W.1, to be returned by 24 May, 1954. Quote reference ET/480. (H 616)

SOUTH WESTERN GAS BOARD
Bristol-Bath Division

SHIFT POWER PLANT ATTENDANTS

APPLICATIONS are invited for the position of Shift Power Plant Attendants at the Stapleton Rd Works, Bristol.

Applicants should have had suitable training and experience in the operation of Turbo Alternators and High Tension Switchgear. The plant will operate in parallel with the B.E.A.

Duties will include the keeping of Electrical and Gas Manufacturing Records.

Conditions and Wages are governed by the N.J.I.C. for the Gas Industry and at present amount to £9. 9s. per week of six eight-hour shifts.

Applications in writing, giving details of present position and previous experience and other relevant information, should be posted to arrive not later than 12 May, 1954, to: C. R. Ingham, Esq., Production Engineer and Manager, South Western Gas Board, Bristol/Bath Division, Radiant House, Bristol, 1. (H 640)

BRITISH ELECTRICITY AUTHORITY
South Eastern Division

SHIFT CHARGE ENGINEER—Littlebrook Power Station. Applications invited from Engineers with sound technical education, experience and administrative ability, who desire experience in an expanding modern Power Station as Charge Engineer, with ultimate object of obtaining a managerial position. Housing not difficult. N.J.B. Conditions of Service, Class M, Grade 7, £1,035. 6s. including London Allowance. Subject to Authority's Superannuation Scheme. Applications endorsed ET to the Power Station Superintendent, Littlebrook Power Station, Dartford, Kent, not later than 14 May, 1954. (H 612)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED GENERAL ASSISTANT ENGINEER at District 342 (Merthyr) in the Central Sub-Area.

Applicants should have a sound experience of the layout and construction of mains and substations.

Salary—Class E, Grade 7 (£649/£665/£681) of N.J.B. Schedule.

Applications stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 15 May, 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. (H 636)

BRITISH ELECTRICITY AUTHORITY
N. West Merseyside and N. Wales Division

VACANCY No. 65/54. MECHANICAL DRAUGHTSMAN, Generation Construction Department, Agecroft, near Manchester. Applicants should have had experience of general mechanical engineering or the layout of generating stations. Salary within range £433/£567 or £567/£671 according to qualifications and experience.

Applications, quoting vacancy No. should be sent to the Divisional Controller, British Electricity House, 825 Wilmslow Rd, Manchester 20. (H 603)

THE SOUTH WEST SCOTLAND ELECTRICITY BOARD
Ayrshire Sub-Area

APPLICATIONS are invited for the undernoted appointments at Sub-Area Headquarters, Kilmarnock.

(i) THIRD ASSISTANT ENGINEERS
(Shift Control)

The duties, which will be carried out in accordance with a continuous shift rota, will comprise switching operations, voltage regulation, the recording of data, etc., in connection with the control of an extensive 33 kV and 11 kV distribution system.

Salary: N.J.B. Agreement—Grade 10, Class "G"—£608/£630 per annum.

(ii) GENERAL ASSISTANT ENGINEER
(Meter and Test)

Applicants should have had experience in modern systems of protection and communication, and in the routine maintenance and testing of components.

Salary: N.J.B. Agreement—Grade 13, Class "G"—£496/£514 per annum.

(iii) JUNIOR ENGINEER
(Meter and Test)

Applicants should have had training on protective systems.

Salary: N.J.B. Agreement—Grade 16/14, Class "G"—£402/£491 per annum.

The above appointments are superannuable. Applicants should include in their application full details of technical training, qualifications and experience.

Forms of application may be obtained from the undersigned or any other Sub-Area Manager and should be returned to me, duly completed, with any additional information not later than 25 May, 1954.

A. E. ROOTS,
Manager.

Greenholm St,
Kilmarnock.
3 May, 1954. (H 660)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

Essex Sub-Area Headquarters

Brentwood
47/54 R
THIRD ASSISTANT ENGINEER
Control (Shift Duties)

Candidates, of Higher National Certificate standard, should have a wide experience in the operation and control of a large high voltage distribution system, be fully conversant with the British Electricity Safety Rules (Distribution) and be capable of taking charge of all system operation, during their shift, in the Essex Sub-Area.

Salary in accordance with Class K, Grade 10, of the National Joint Board Salary Agreement, commencing at £719, plus London Weighting.

Apply to the Manager, Essex Sub-Area, Eastern Electricity Board, "Millfield," Bentley, nr. Brentwood, Essex.

Suffolk Sub-Area

Bury St. Edmunds and Ipswich Districts
DEMONSTRATORS
48 and 52/54 R

Candidates should have had Domestic Science training including Electrical Housecraft, should preferably hold the E.A.W. Certificate and be competent to plan and give cookery demonstrations, including lectures and advice to consumers on the utilisation of domestic electrical appliances. Previous experience in an Electricity Service Centre is desirable.

Salary in accordance with Grade 1 (£400 by £20—£480 by £10—£490) of the National Joint Council Salary Agreement, although progress beyond £440 will be subject to a certificate that the person concerned is capable of undertaking all the duties of the grade.

Apply to the appropriate District Manager at the following addresses:

The District Manager—Bury St. Edmunds, Eastern Electricity Board, 4 Cornhill, Bury St. Edmunds, Suffolk.

The District Manager—Ipswich, Eastern Electricity Board, Electric House, Ipswich, Suffolk.

Future salary and conditions of service for the above appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

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The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, by letter, stating age, education, qualifications and experience, with details of present appointment and salary, should be submitted to the Manager concerned within fourteen days of the appearance of this advertisement. (H 642)

LONDON ELECTRICITY BOARD
Chief Engineer's Department

APPLICATIONS are invited for positions in the Drawing Office in Central London. Applicants should preferably have served an engineering apprenticeship and have had good technical training, together with experience in the layout of transforming plant, switchgear and cables for operation on voltages up to 66 kV.

Senior and Engineering Draughtsmen are required for plant layout and for diagram work, and a knowledge of modern protective systems would be an advantage.

Commencing salaries will be according to qualifications and experience within Grade 5 or 6 under Schedule "D" of the N.J.B. agreement:

Senior Draughtsman—Grade 5, £595. 7s. to £704. 11s. p.a.

Engineering Draughtsman—Grade 6, £458 to £595. 7s. p.a.

The above figures are inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46, New Broad St, E.C.2. Please enclose addressed envelope and quote ref.: V/1736/T. (H 661)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

APPLICATIONS are invited for positions as JUNIOR CHEMISTS at Hams Hall, Nechells, Meaford, Stourport, Walsall and Ironbridge Power Stations. N.J.B. service conditions, superannuable appointments, commencing salary £402 per annum.

Applicants should have had practical laboratory experience, preferably connected with water, fuel and oil, and should possess Ordinary National Certificate in Chemistry or be pursuing a course of study for a higher qualification.

Apply quoting vacancy number 656 MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 22 May 1954. (H 647)

BRITISH ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for the post of:

ASSISTANT SHIFT CHARGE ENGINEER, PORTSMOUTH GENERATING STATION
S/13.521

Applicants should preferably be in possession of technical qualifications admitting to corporate membership of a recognised professional institution, have had previous experience in a large modern generating station and preferably have had manufacturing works experience. Duties will include work in both turbine and boiler houses.

Salary N.J.B. Class G, Grade 9. £641/£667.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 19 May, 1954. (H 659)

SOUTHERN ELECTRICITY BOARD
REFRIGERATION REPRESENTATIVE

YEOVIL District of No. 4 (Bournemouth) Sub-Area. Salary N.J.C. Grade 3 (£545/£605 per annum), N.J.C. Conditions of Service.

Candidates should have experience of commercial refrigeration applications, be able to prepare specifications and estimates, conduct negotiations and obtain new business.

The successful candidate will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible.

Applications on the standard form and in envelopes suitably endorsed must reach the Sub-Area Secretary, 1 Priory Rd, Bournemouth, not later than 21 May, 1954 (H 644)

APPLICATIONS are invited by The English Electric Co. Ltd., Liverpool, from ENGINEERS with good technical qualifications and with design and development experience in one or more of the following:

(a) Domestic Electric Cookers.
(b) Cooker Hotplates—solid and/or radiant.
(c) Thermostatic switches, process timers, solenoid operated switches, etc.
(d) Domestic laundry equipment.
(e) Sealed refrigerator compressors.

The vacancies occur in the Engineering Departments of the Company's Domestic Appliance Division and suitable applicants will be engaged in senior positions, in which they will be required to carry their full share of responsibility for the design and development of entirely new products. Salaries will be commensurate with the applicant's experience, and the degree of responsibiilty called for by the position for which he is chosen. Reply stating age, experience, qualifications, and quoting ref. 452H, to Dept. C.P.S., 336/7, Strand, W.C.2. (H 559)

ASSISTANT WORKS MANAGER required by well known Domestic Appliance Manufacturers in Home Counties. Applicants should be between 35 and 40 years of age and have good technical qualifications, backed by wide experience in mass production, having held position of responsibility. Should be conversant with modern production methods, and have knowledge of press and sheet metal work, welding assembly and finishing processes. Replies, which will be dealt with in confidence, should give full particulars of education, positions held and salaries. Starting salary will be commensurate with age and experience and there are good prospects for the right man.—Box No. 3497, Electrical Times. (H 589)

AIR MINISTRY require MECHANICAL AND ELECTRICAL ENGINEERS in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation stations. Appointments in two grades (a) Main Grade, salary scale £1,000 to £1,320 (b) Assistant Grade £650 to £1,000. Starting pay according to qualifications and experience. Salaries somewhat lower in provinces. Candidates should be age 25 or over. Appointments temporary and non-pensionable but with long term possibilities. Special allowance up to £1,300 a year according to location payable in addition to salary during overseas service. Candidates must be natural born British subjects of natural born British parents.

Minimum qualifications and experience for both grades of posts:

(i) (a) University degree or equivalent diploma in electrical and/or mechanical engineering and at least a two year apprenticeship or (b) Graduate or Corporate Membership of the Institutions of Mechanical or Electrical Engineers with appreciable electrical engineering experience and at least three years' apprenticeship and (ii) employment in responsible position for minimum of three years with well established engineering concern providing wide experience in electrical and mechanical engineering practice.

Application forms quoting reference D1/54A from M.L. and N.S., Technical and Scientific Register (K), Almack House, 26 King St, London, S.W.1. (H 618)

AN old established company in South East London has a vacancy for an EXPERIENCED ENGINEER as senior assistant to the head of the Development Department. Experience of the design of AC and DC machines up to 50 kW and also of small electromechanical devices is required. Some knowledge of electronics would be an advantage. This position is one of exceptional possibilities for the right man. A university degree and corporate membership of the Institution of Electrical Engineers is essential. Reply giving details of experience, age and salary required, to Personnel Manager, Box 2Y E7767, A.K. Advg., 212a Shaftesbury Ave, London, W.C.2. (H 620)

ELECTRICAL DRAUGHTSMEN

The English Electric Company Limited

have vacancies at their Liverpool Works for ELECTRICAL AND MECHANICAL DRAUGHTSMEN for interesting work on a wide variety of new projects. The essential requirements are previous experience as a draughtsman on the design and detail of circuit diagrams or any kind of light electromechanical equipment, mechanisms, sheet steel cubicles, die-castings, or welded fabrications for batch production.

Pensionable and progressive positions are offered to men with initiative.

Travelling expenses for interview will be paid. Write giving full details of age, qualifications, and experience, to **Dept. C.P.S., 336/7 Strand, W.C.2,** quoting Ref. 1099A. (H 648p)

AN old established Engineering Company in the London Area has vacancies in its Estimating and Tendering Department for young ENGINEERS of National or Higher National standard for the preparation of estimates of specialised electric lighting and heating installations. Should be conversant with wiring and conduit schemes and a knowledge of air conditioning an advantage. Ultimately required to prepare final tenders and handle correspondence. Good opportunities for advancement. State age and experience. Write Box 2V E5994, A.K. Advg., 212a Shaftesbury Ave, London, W.C.2. (H 619)

ASSISTANT ENGINEER required for lighting development, must be prepared to work in Glasgow or some other provincial centre. Ability to lecture essential. Membership of the I.E.E. or equivalent; age 25-35. Please apply to: The E.L.M.A. Lighting Service Bureau, 2 Savoy Hill, London, W.C.2. (H 666)

CHLORIDE BATTERIES LTD. invite applications from Graduate Electrical Engineers, preferably with an Honours Degree to fill a vacancy in their Engineering Department. Candidates should be not more than 27 to 28 years of age and should have completed full-time National Service obligations, but applications will be considered from suitable candidates at present in the Forces who are due for release within the next few months. Previous industrial experience, although desirable, is not essential. The successful candidate will be given training in all aspects of storage battery engineering and associated electrical equipment, and in all relevant matters relating to the manufacture, design, development and application of storage batteries. For a person of the right calibre and potential the post offers considerable opportunities for advancement with the ultimate prospect of an executive position within the Organisation. An attractive salary will be offered during the training period. A non-contributory pension scheme is in operation. Applications should be addressed to the Chief Personnel Officer, Exide Works, Clifton Junction, Swinton, Manchester. (H 609)

CONTACTOR Switchgear Ltd. ENGINEERS required for Engineering Department for control gear applications up to 1,000 h.p. low and high tension.

The Company operates a contributory pension scheme and will share cost of removal in approved cases. Applicants should have completed their National Service and be preferably not over 45. Write in confidence to the Secretary, Moorfield Rd, Off Upper Villiers St, Wolverhampton. (H 599)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.2.

DEPUTY POWER STATION SUPERINTENDENT required for a new Power Station of 30 MW capacity together with a Distillation Plant having a capacity of two millions gallons per day installed in the State of Kuwait, Persian Gulf. Applicants should have held a Deputy Station Superintendent's position for at least three years. Preference will be given to applicants under 40 years of age. Experience with oil and gas fired boilers, condensing and back pressure turbo-alternators and large triple effect evaporators will be an advantage. Applicants should also have a working knowledge of Power Station chemistry. Full details of qualifications, training and experience must accompany the application. The starting salary offered is from £1,300 to £1,500 per annum according to experience, plus a living allowance. Free furnished bachelor quarters and medical attention are provided. The contract in the first instance is for two years and may be extended. Married accommodation is difficult and applicants must be prepared to occupy bachelor accommodation for at least the first year of service. Applications to be addressed to the Secretary, Ewbank and Partners Limited, Engineering Consultants, 10/11 Grosvenor Place, London, S.W.1. (H 615)

DESIGNER - ELECTRICAL. Domestic appliance manufacturer located in Glasgow area, and of world repute, requires the services of a senior electrical engineer to take charge of development section. Applicants should have experience of the design and development of domestic electrical appliances for volume production. The post, which is a permanent one, offers ample scope for advancement for a man of ability and initiative. Give details of qualifications, experience and salary required which will be treated in strict confidence. Pension Scheme in operation.—Box No. 3511, Electrical Times. (H 607)

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DRAUGHTSMAN of H.N.C. standard required, fully experienced in Power Transformers of highest voltages and capacities.

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DRAUGHTSMAN required for Electric Elements and Thermal Devices Manufacturers, to assume responsibility for experimental drawing office and records. Knowledge of presswork and press tool design an advantage. A distinct opportunity. House available if required. Five-day week. Pension Scheme, Canteen, etc. State briefly age, experience, technical training, salary, whether married with family to: Works Manager, Best Products Ltd., Felixstowe, Suffolk. (H 663)

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Walton-on-Thames, Surrey

Stating salary required and details of experience. (H 656)

ELECTRICAL manufacturers require Technical Sales Representatives. (1) Lancashire and North Wales, living Manchester area; (2) Scotland, living Glasgow area. About 35/40, with knowledge electric heating. Write fully informative applications to Box Y.503, Willing's, 362 Grays Inn Rd, London, W.C.1. (H 667)

ELECTRICAL ENGINEER required for British West Africa to assist the Chief Engineer in the preparation of specifications and estimates for electrical transmission. distribution and installation and to supervise contract work. Remuneration approximately £1,000 p.a. Pension scheme, free accommodation, good leave with free passages. Apply giving full details of previous experience and whether married or single.—Box No. 3519, Electrical Times. (H 649)

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ELECTRICAL DRAUGHTSMAN, 25-30, H.N.C. standard, preferably familiar with heavy industrial plant, practice and layout. Knowledge of distribution systems up to 3,300 V. A.C. and D.C. motor control schemes and preparation of schematic diagrams. Salary depending on age and experience. Superannuation scheme. Applications to be received by 17 May addressed to Electrical Engineer, Guest Keen Baldwins Iron and Steel Works, Cardiff. (H 537)

ELECTRICAL MACHINE DESIGNER. A. Reyrolle and Company Ltd., have a vacancy in their Rotary Equipment Department for an Engineer to assist in the design and development of A.C. generators and motors, including communator motors. Applicants should have had training and experience in this class of work and should possess at least the Higher National Certificate in Electrical Engineering. Preference will be given to Corporate Members of the Institution of Electrical Engineers. Please apply with full particulars to the Chief Engineers, A. Reyrolle and Company Ltd., Hebburn, Co. Durham. (H 662)

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Candidates must be medically fit for service in the tropics and preferably not more than 40 years old.

Applications (which will be treated as strictly confidential) should be as complete as possible and should be addressed to the

Managing Director
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Charlton, London, S.E.7

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(H 545p)

ELECTRICIAN wanted by small factory in Birmingham area, to take sole charge of maintenance of approx. 150 motors, ¼ h.p.—25 h.p., switchgear and lighting installation.—Box No. 3503, Electrical Times. (H 592)

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Applications giving full particulars of training and experience together with salary required, to Employment Manager, Johnson and Phillips Ltd., Victoria Works, Charlton, S.E.7. (H 627)

JUNIOR required for the Estimating Dept. of a firm manufacturing electric motors and allied apparatus to assist in the preparation of tenders and quotations. Preferably with some works and test bed experience. London District. Give full details of experience and salary required. —Box No. 3479, Electrical Times. (H548)

JOHNSON AND PHILLIPS LIMITED have vacancies in their cable ESTIMATING DEPARTMENT, preference will be given to men experienced in preparation of estimates of cost of rubber insulated cables and flexibles also thermoplastic cables. Applications giving age, experience and salary expected should be addressed to Employment Manager, Messrs Johnson and Phillips Limited, Victoria Way, Charlton, London, S.E.7. (H 528)

LIGHTING ENGINEER with experience in planning of Street Lighting and Industrial Lighting installations required by Revo Electric Co., Ltd., at their Head Office in Tipton. Apply in writing giving details of technical qualifications and experience to the Personnel Manager, Revo Electric Co., Ltd., Tipton, Staffs. (H 626)

MECHANICAL ENGINEER of Higher National Certificate standard with some drawing office experience and knowledge of strength of materials, design of small drop forgings and malleable iron castings required to accept technical responsibility for design of overhead line hardware including prototype development and testing.

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Apply, stating age, experience and qualifications, to the Chief Personnel Officer, Pilkington Brothers Limited, St. Helens, Lancashire. (H 650)

MERZ AND McLELLAN require a MECHANICAL ENGINEERING DRAUGHTSMAN for their Esher Office. Applicants should be fully experienced in layout work, preferably in connection with steam power station design. The salary offered will be fully appropriate to the applicant's experience. Pension Scheme. Five-day week. Apply in writing to Merz and McLellan, "Milburn," Esher, Surrey. (H 658)

PROJECT ENGINEER (Distribution) required for the Electrical Development Section of the Steel Company of Wales Limited (Steel Division), Port Talbot.

Candidates should be familiar with design and installation of distribution schemes connected with modern Iron and Steel Works, should have had experience with Switchgear Manufacturers and be conversant with protection and control equipment.

Higher National Certificate or equivalent desirable.

Those wishing to apply should write for official application form to the: Personnel Superintendent, The Steel Company of Wales Limited, P.O. Box No. 3, Port Talbot, Glam. (H 652)

PROJECT ENGINEER (Electrical Installation) required by the Steel Company of Wales Limited (Steel Division), Port Talbot, in their Electrical Development Section.

Candidates should be familiar with design of electrical installations connected with modern steelworks. A knowledge of lighting practice and communications would be an advantage.

Higher National Certificate or equivalent desirable.

Those wishing to apply should write for official application form to the Personnel Superintendent, The Steel Company of Wales Limited, P.O. Box No. 3, Port Talbot, Glam. (H 664)

RESEARCH ENGINEERS with Electrical Engineering Degree (preferably Hons.) who have completed National Service, required for fundamental and applied research on electromagnetic systems, arc control, electrical contact phenomena, and electronic devices. Posts are pensionable, salary according to age and experience. Apply Personnel Manager, Brookhirst Switchgear Ltd., Chester. (H 651)

REPRESENTATIVE required for electrical wholesalers E.W.F., E.L.M.A., C.M.A., etc.

Salary, commission and expenses. Apply, or telephone for appointment, giving details of experience. Managing Director, E. Dawson (Lamp Factors) Ltd., 10 Grays Inn Rd, London, W.C.1. (H 665)

SALES ENGINEER required by Siemens Electric Lamps and Supplies Limited for the Midland area. Applicant to have knowledge of electrical products, particularly all types of cables, and mains equipment. Technical training necessary, sales experience an advantage. Contacts to be made with Electricity Boards, Government Depts., Architects/Consultants and Industrial Engineers. Write giving details of qualifications, present duties and salary level to The Manager, 8/10 Albert St, Birmingham 4. (H 613)

SENIOR TEST ENGINEER is required by The English Electric Company Ltd. for their Whetstone establishment near Leicester, to look after and be responsible for all test plant equipment both mechanical and electrical in a modern engineering works concerned with various development and production projects. Write, giving full details of previous experience and quoting ref. 1300 to Dept. C.P.S., 336/7, Strand, W.C.2. (H 558)

SENIOR DRAUGHTSMEN required for design of 11 kV metalclad switchgear equipment. The position offers good prospects. Superannuation scheme. Five day week, modern factory. Applications giving full particulars of previous experience, qualifications and salary required to the Personnel Manager, South Wales Switchgear Ltd., Blackwood, Mon. (H 540)

SENIOR AND JUNIOR DRAUGHTSMEN required for switchgear development work. Good salary offered to suitable applicants. Pension scheme available. Apply stating age, salary and full details of technical qualifications and experience to Erskine, Heap and Co., Ltd., Lancashire Switchgear Works, Salford, Manchester 7. (H 570)

TRANSFORMER SALES ENGINEER, preferably with design experience, required by non ring firm. Must have extensive commercial experience, and be capable of controlling and developing sales organisation. Apply—Box No. 3517, Electrical Times. (H 628)

TRACER (Female) fully experienced, for Electrical and Mechanical Engineering layout work. Must be neat worker and good letterer. Five-day week. Apply in writing to Merz and McLellan, "Milburn," Esher, Surrey. (H 657)

TRANSFORMER ENGINEERS REQUIRED. Salary commensurate with experience and ability. Apply in writing stating age, qualifications and previous experience, to Personnel Manager, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester 17. (H 575)

THE Switchgear Contracts Department of The English Electric Co., Ltd., Stafford, has vacancies for SENIOR ENGINEERS. Applicants should have recognised technical qualifications. A knowledge of modern switchgear and control gear practice, or of the protection and control of HV systems, transformers and generators or large industrial machine drives, is desirable. Drawing office, test or operating experience will be considered an advantage. JUNIOR ENGINEERS with HNC and engineering experience, preferably with a commercial bias, are also required. Please write to Dept. C.P.S., 336/7, Strand, W.C.2, quoting ref. 446F. (H 515)

THE Telegraph Construction and Maintenance Co., Ltd., cable manufacturers, require an ESTIMATOR. Experience of cable estimating preferred, but applicants with sound knowledge of cable manufacturing methods would be carefully considered. Must have completed National Service. Educational standard: G.C.E. (ordinary level) would be an advantage. Pension scheme, five-day week and all welfare facilities. Salary according to qualifications and experience. Write details to: Staff Officer, Telcon Works, Greenwich, S.E.10. (H 608)

WELL KNOWN Electrical Manufacturing Company has vacancies for SALES ENGINEERS for electrical rotating machinery in Birmingham and Manchester. Successful applicants must be trained Electrical Engineers with O.N.C. as a minimum qualification and with previous sales experience in the areas covered. They will work from the Company's existing Branch Offices. Remuneration by salary and expenses. Non-contributory pension scheme.—Apply—Box No. 3505, Electrical Times. (H 593)

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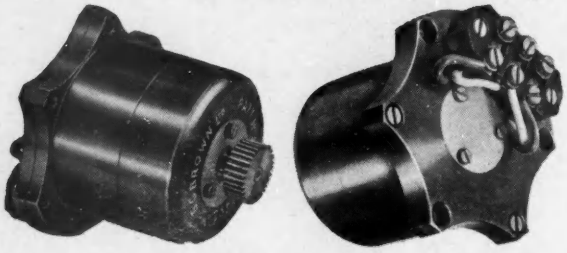

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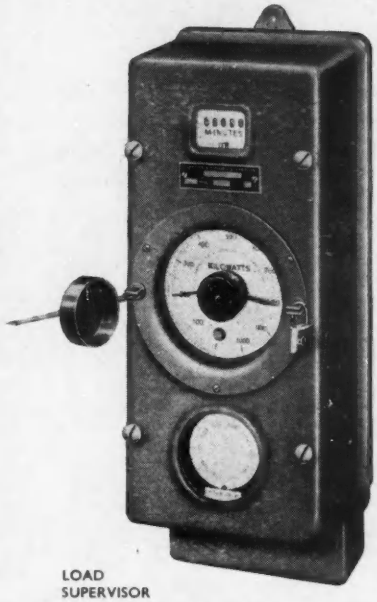

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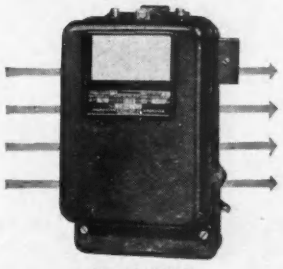

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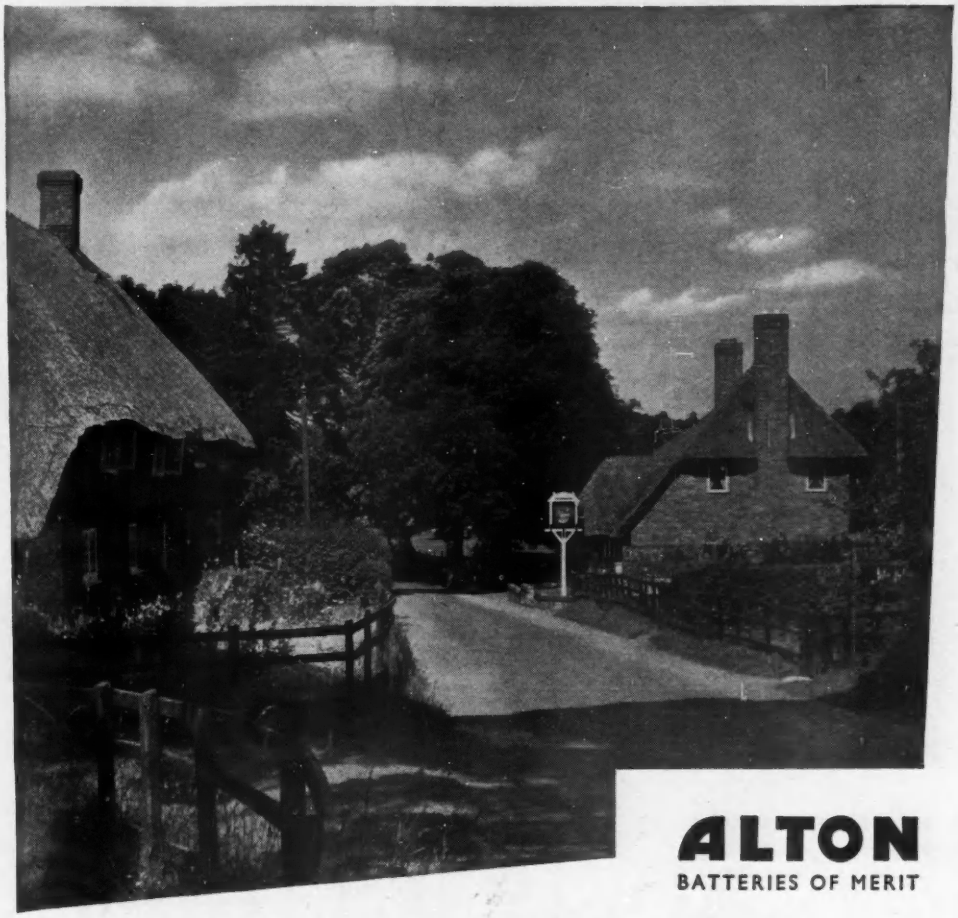
Know this village? If you worked at the Alton Battery works you'd know it well—and a dozen others like it. You'd know the lanes that lead to each. You'd know the streams—and the fish in them: the pubs and the beer they cool in their cellars, the teas they serve on their lawns . . . . Alton's a country town—and the men it breeds are countrymen at heart. Men with roots in their birthplace. Men with a quiet pride in themselves and the patient skill of their hands. A clipped yew hedge in his garden . . . a battery plate at 'the Works' . . . *making something better than merely well comes very naturally to an Alton man.*



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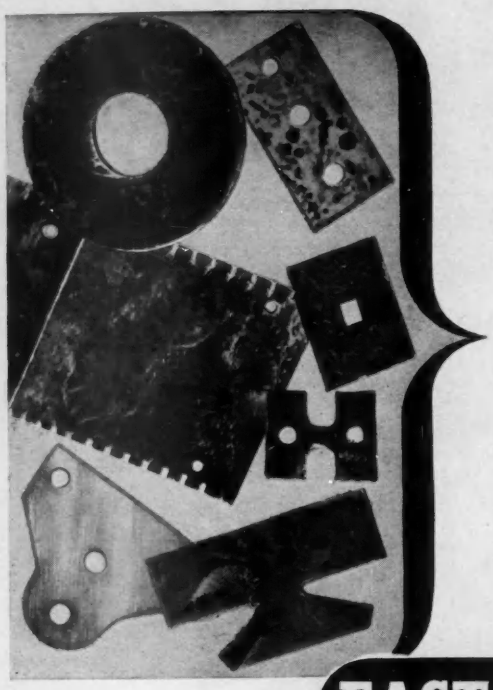

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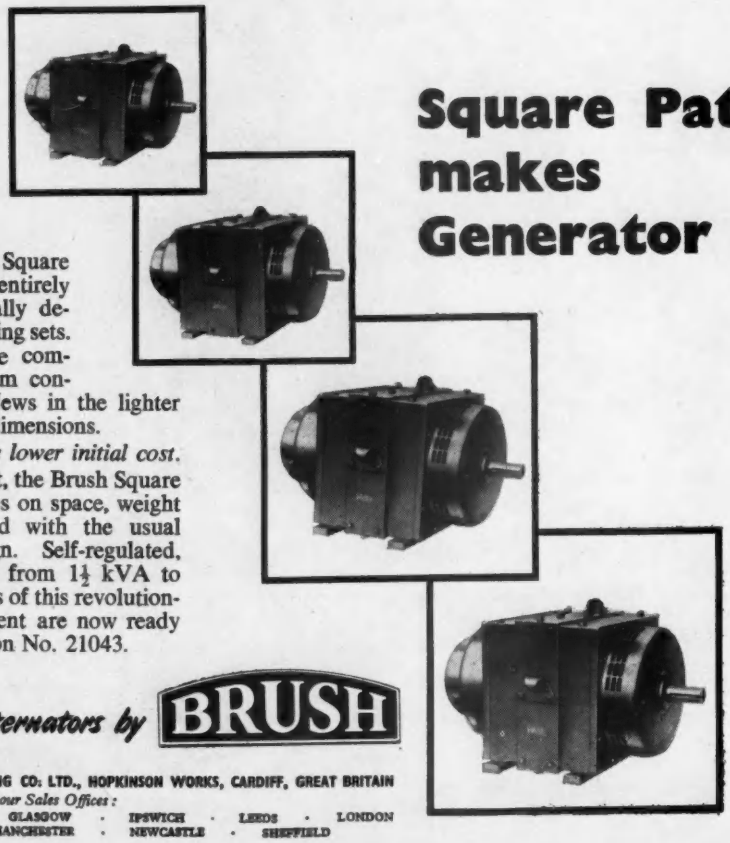

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Here is the Brush Square Path Alternator—an entirely new machine specially designed for small lighting sets. There's news in the complete breakaway from conventional design. News in the lighter weight and smaller dimensions.

And big news in the lower initial cost. Kilowatt for kilowatt, the Brush Square Path Alternator saves on space, weight and price compared with the usual circular frame design. Self-regulated, self-excited; outputs from 1½ kVA to 35 kVA. Full details of this revolutionary Brush development are now ready in the new Publication No. 21043.

SQUARE PATH alternators by **BRUSH**

THE BRUSH ELECTRICAL ENGINEERING CO. LTD., HOPKINSON WORKS, CARDIFF, GREAT BRITAIN

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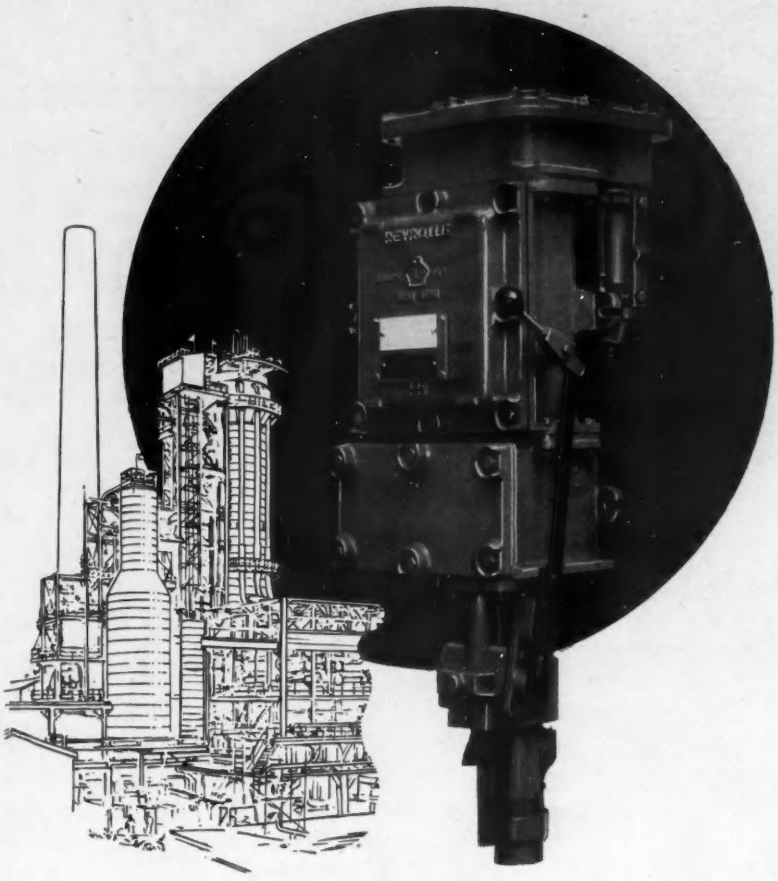

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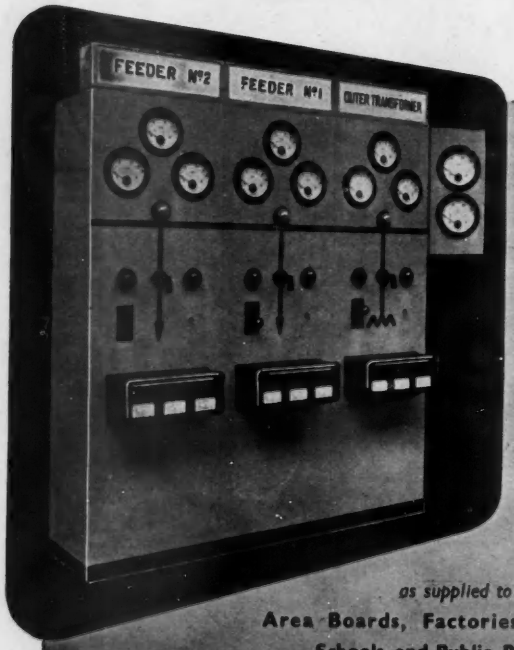

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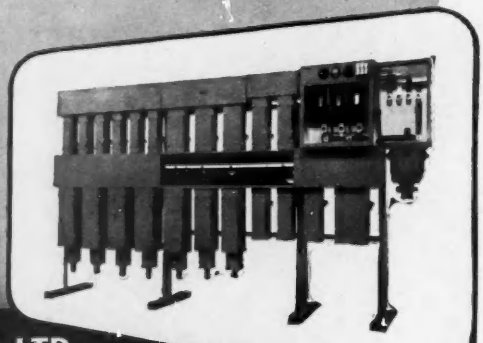

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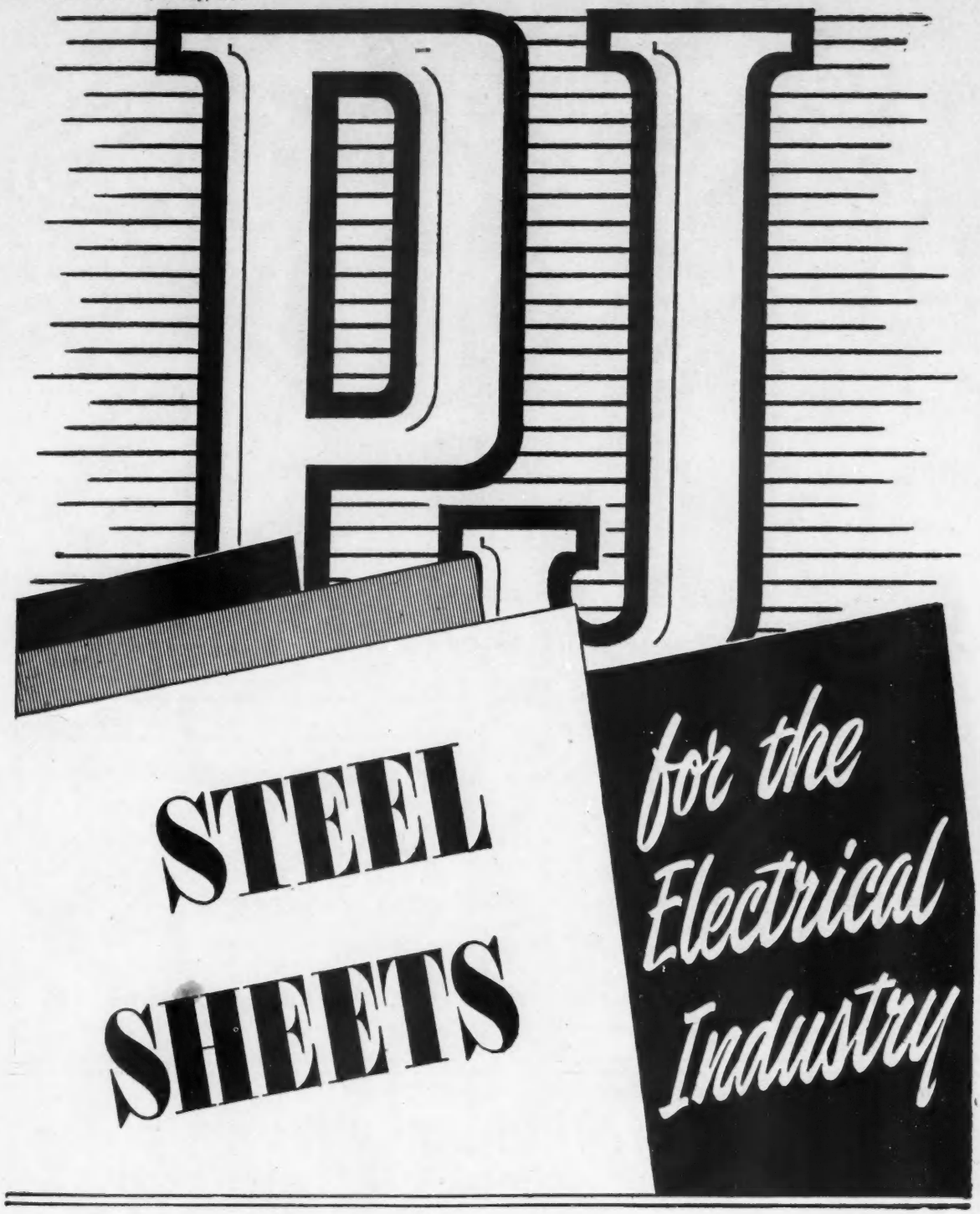

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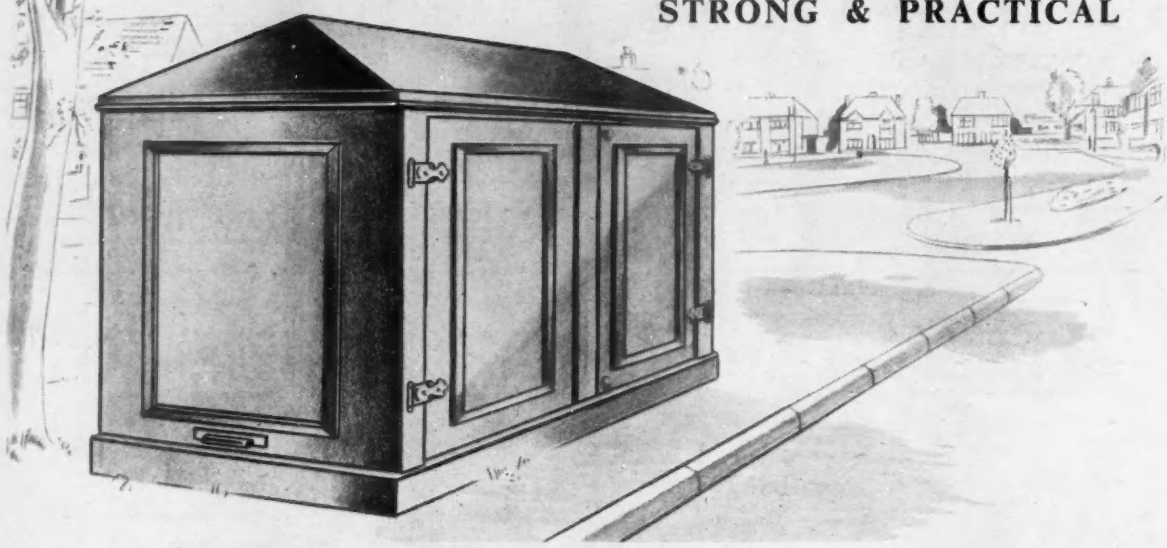

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AN *Essential* FOR EVERY TEST ROOM

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The high voltage testing of electrical apparatus has long been recognised as an essential part of test room procedure, and to comply with these requirements the model A2 Test Set is introduced. This unit incorporates a continuously variable transformer controlling the input to the high voltage transformer, thereby providing a smooth application of high voltage to the equipment under test, thus avoiding any tendency for voltage surges.

BRIEF DETAILS—Model A2

Output: 2.5 kV at 250 V.A.

Size: Length 17″ Width 9½″ Height 10″
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Case: Portable, louvred ventilated sheet steel case of pleasing appearance, finished in glossy grey and fitted with one carrying handle on the top of the case.

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Voltmeter: Double range flush mounting voltmeter connected in primary but scaled to read output voltage.

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SLIM BATTEN

40 watt.
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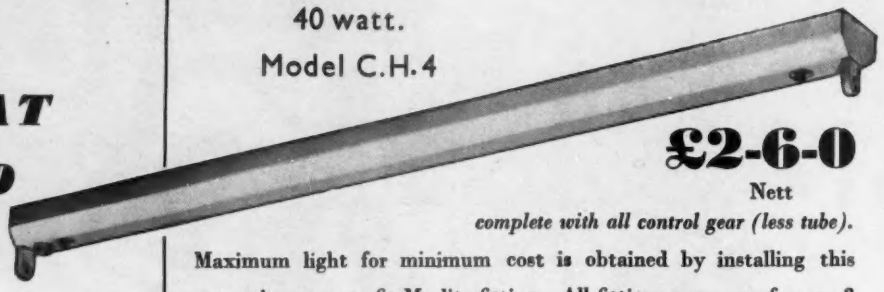

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complete with all control gear (less tube).

Maximum light for minimum cost is obtained by installing this attractive easy-to-fit Morlite fitting. All fittings carry our famous 2 years' unconditional guarantee. Speedy delivery—available from stock. Send for illustrated catalogue of complete range.

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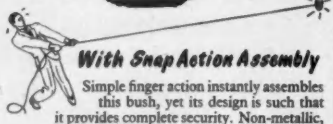
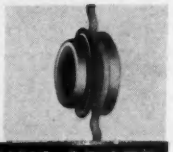
Here's a Bush..

That WON'T come out



With Snap Action Assembly

Simple finger action instantly assembles this bush, yet its design is such that it provides complete security. Non-metallic, high dielectric, fully tropical. Approved all services. Samples and literature on request.



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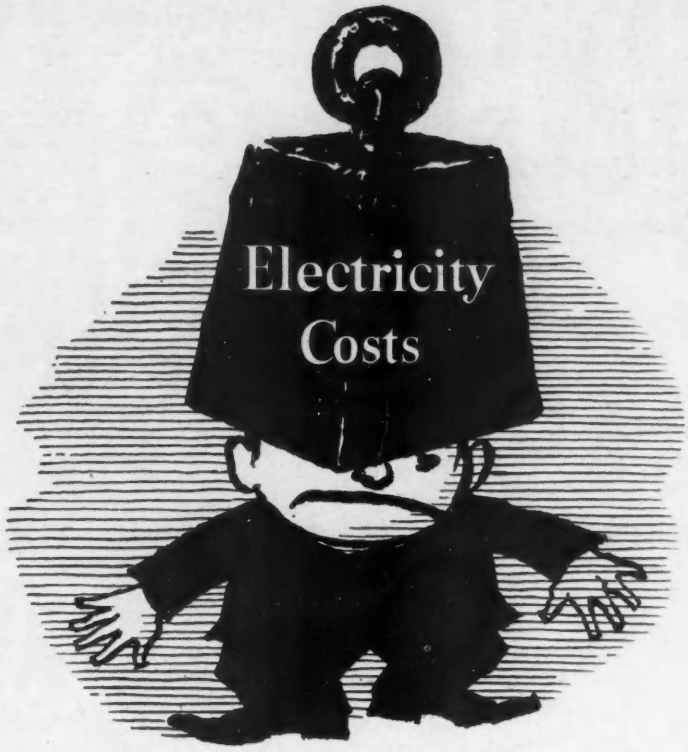

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Save on your electricity costs with

Power Factor Correction Capacitors

The installation of Dubilier Capacitors for power factor correction, effects such substantial saving in cost of power that the capital outlay is recovered in a short period of time. Occupying minimum floor space and requiring no maintenance, Dubilier Power Factor Correction Capacitors are absolutely reliable. Is there room for such improvement in *your* factory? Our engineers will carry out a full investigation of your present power factor and advise you without cost or obligation.

A small factory installed a Dubilier Capacitor to correct their power factor from 0.68 to 0.95, thus reducing their maximum demand from 28kVA to 20kVA.

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Before installing Capacitor ...	276	12	0
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Saving per annum	**48**	**0**	**0**

Approximate cost of Capacitor equipment £65.0.0 *thus paying for itself in little over a year.*

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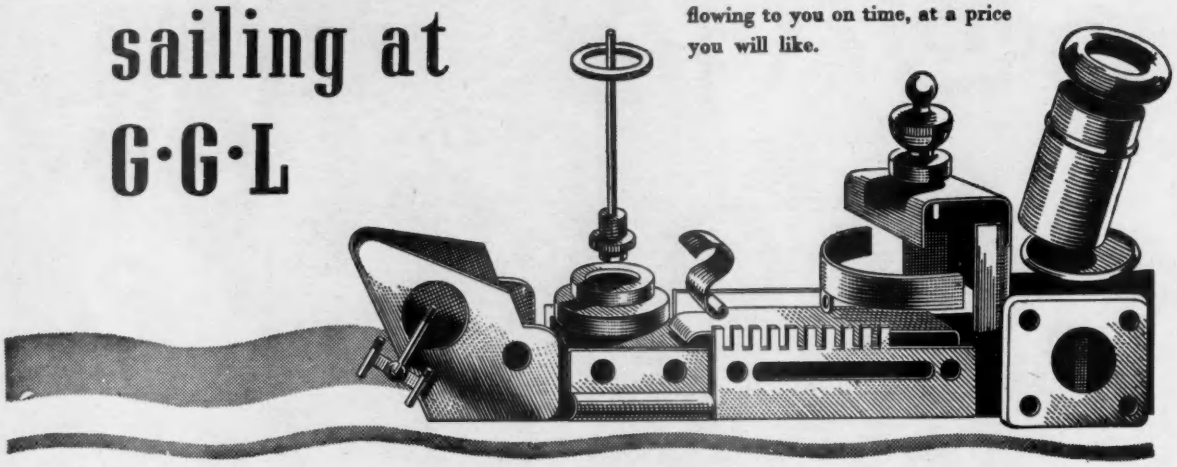

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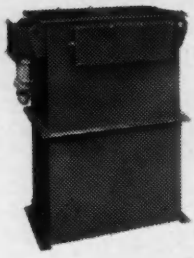

Sturdy Transformers are manufactured from 1 kVA to 100 kVA for all industrial applications and our technical service is always at your disposal.

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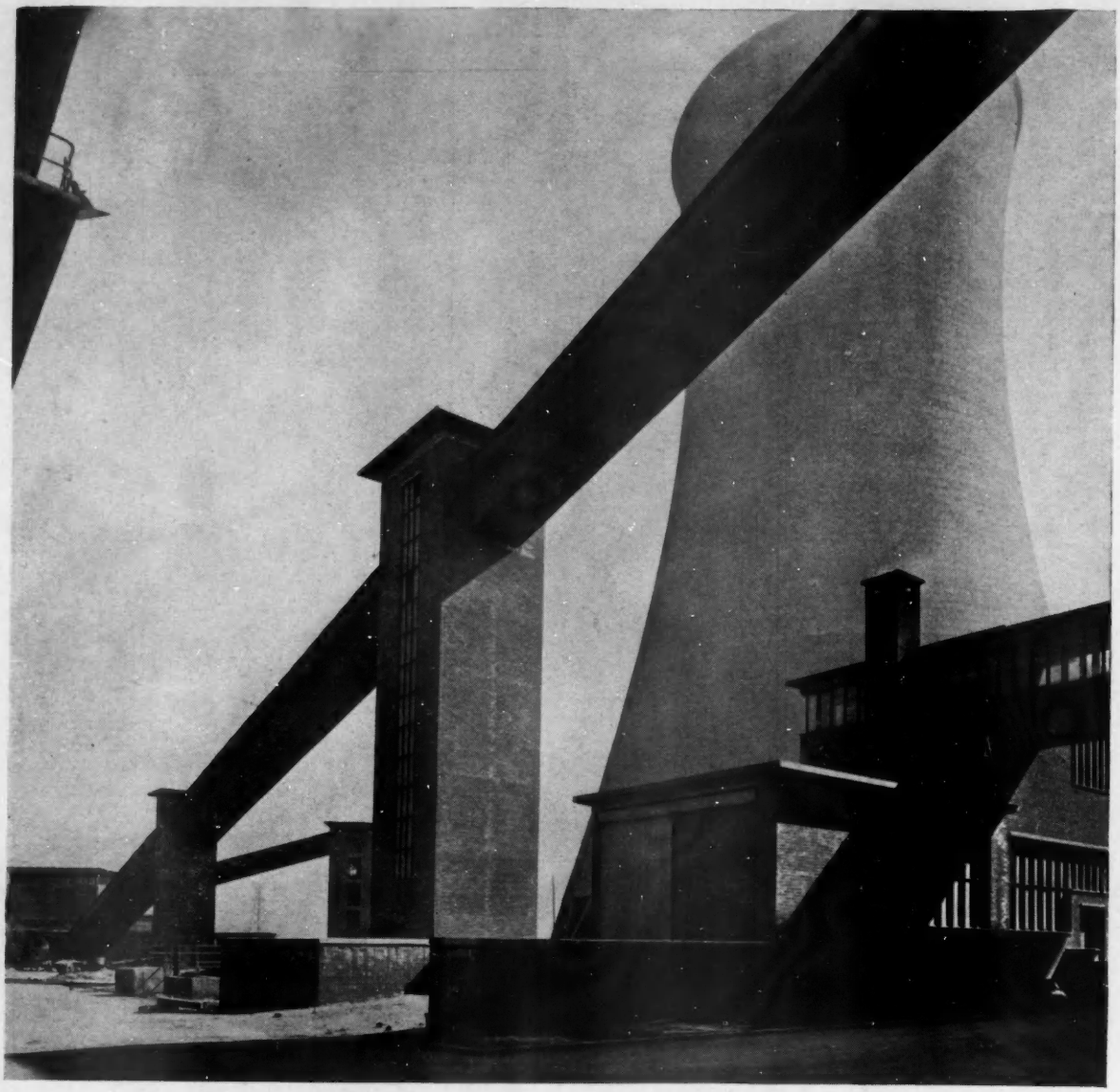

DESIGNED FOR EFFICIENT HANDLING

Now in commission at the Huncoat (Accrington) power station, this coal handling plant is one of many designed and built by Simon-Carves at home and abroad. Wide experience of the mechanical and pneumatic handling of coal, coke breeze, and many other fuels qualifies Simon-Carves to advise on fuel handling and preparation problems.

Coal handling plant by

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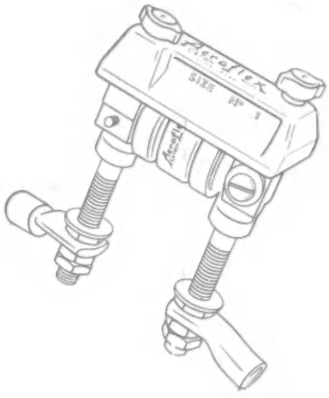
Aeroflex Ceram HOPES PATENTS

LINK TYPE FUSE UNITS

REWIREABLE CARTRIDGE FUSE LINKS

These fuse units are ideal for substations, distribution pillars and sealed service boxes, where fully shrouded gear is not required. The method of locating the fuse link is shown in the illustration (left), the central bolts having a reduced diameter which permits withdrawal of the fuse without disengaging the bolt. Tightening the moulded knobs in the handle forces a wedge contact against the fuse tongues ensuring a first class connection.

MADE IN 3 SIZES
No. 1 — Up to 200 AMPS.
No. 2 — Up to 400 AMPS.
No. 3 — Up to 600 AMPS.
25 MVA Breaking Capacity



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dmPH70

A series of high speed flashes from six Mazda electronic flash tubes enabled Roger Wood, F.I.B.P., F.R.P.S., to take this remarkable photograph.

Almost every important lighting development in the last 50 years owes something to BTH

THE SAME RESEARCH and manufacturing resources which produced the first jet engine of Whittle design and the electrical power system of the Comet are also behind Mazda lamps.

For half a century BTH has maintained its reputation for leadership in lighting. During that time many of its developments have become standard throughout the world.

Here are three examples from literally hundreds of recent achievements in the field of lighting.

200,000 FEET OF FLEXIBLE LIGHTING

A fluorescent lighting system that can readily be switched around to meet changes in the layout of the factory floor. This is one of the contributions to industrial lighting made by the development, by BTH, of universal lighting trunking.

In addition to carrying lamps, reflectors and auxiliary gear which can be sited anywhere along the production line, the trunking also carries other services, such as fire alarms, visual signals, clocks and "Music-While-You-Work".

There are now two hundred thousand feet of Mazda trunking in factories all over the country.

Increased productivity is dependent upon developments such as these; that is why BTH Research is always seeking new ways of providing more efficient and more economical lighting.

EXPLOSIMETER

The explosimeter is a device used on board tankers and in refineries to give warning of any dangerous concentration of inflammable gas. A vital part in the operation and reliability of the equipment is played by a special lamp which forms a ballast in the circuit.

The manufacturers of the explosimeter asked BTH if such a 'lamp' could be manufactured for them in this country. The challenge was accepted and within a matter of weeks tests had been completed.

The samples proved satisfactory, and yet another type of lamp was added to the many thousands (yes thousands — did you know that?) of different types of lamps already manufactured by BTH.

ON THE BALL

The traditional method of floodlighting football fields and arenas has been to mount batteries of high powered projectors on a series of tall and costly towers; BTH lighting engineers were convinced, however, that an entirely new approach should be made to the whole problem.

It took two years to perfect the design of a glare-free projector which could be mounted only a few feet above the heads of the spectators. The results have been nothing short of spectacular. Players and supporters alike have acclaimed the new Mazda system which, by halving costs, has at last put floodlit football within the reach of every professional club and many amateur clubs.

Mazda

the lamps and lighting fittings with

B T-H

behind them

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